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Volume 6, Number 4
(October 1979-December 1979)

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Oil Pollution Abstracts Vol. 6, No. 4 (October 1979 - December 1979)

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This report has been assigned to the INTERAGENCY ENERGY-ENVIRONMENT RESEARCH AND DEVELOPMENT series. Reports in this series result from the effort funded under the 17-agency Federal Energy/Environment Research and Development Program. These studies relate to EPA's mission to protect the public health and welfare from adverse effects of pollutants associated with energy systems. The goal of the Program is to assure the rapid development of domestic energy supplies in an environmentally-compatible manner by providing the necessary environmental data and control technology. Investigations include analyses of the transport of energy-related pollutants and their health and ecological effects; assessments of, and development of, control technologies for energy systems; and integrated assessments of a wide range of energy-related environmental issues.

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OIL POLLUTION ABSTRACTS is a quarterly compilation of current literature and research project summaries. Comprehensive coverage of oil pollution and its prevention and control is provided, with emphasis on the aquatic environment. This issue contains bibliographic citations with abstracts of scientific and technical publications and patents covering the years 1976 to 1979. The literature and research entries are arranged in eight major categories comprised of thirty-seven specific sub-categories. A permuted Subject Keyword Index provides access to every entry, and author and patent indexes are included. This report is submitted in partial fulfillment of EPA Grant No. R805803-01 the the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the US Environmental Protection Agency.

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Patent	Oil pollution control	
Subject indexes	Oil pollution patents	

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March 1980

OIL POLLUTION ABSTRACTS

Volume 6, Number 4
(October 1979 - December 1979)

by

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current literature, research, patents, and other materials relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci, to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL POLLUTION ABSTRACTS is a quarterly compilation of current literature and research project summaries. Comprehensive coverage of oil pollution and its prevention and control is provided, with emphasis on the aquatic environment. This issue contains bibliographic citations with abstracts of scientific and technical publications and patents covering the years 1976 to 1979. The literature and research entries are arranged in eight major categories comprised of thirty-seven specific sub-categories. A permuted Subject Keyword Index provides access to every entry, and author and patent indexes are included. This report is submitted in partial fulfillment of EPA Grant No. R-805803-01 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the US Environmental Protection Agency.

OIL POLLUTION ABSTRACTS - TOPICAL OUTLINE

A. OIL POLLUTION DETECTION AND EVALUATION
  1. Detection and Monitoring
  2. Remote Sensing
  3. Sampling and Analysis
  4. Source Identification

B. OIL POLLUTION PREVENTION AND CONTROL
  1. Containment
  2. Cleanup and Removal
  3. Environmental Restoration
  4. Personnel Training
  5. Contingency Planning and Spill Response
  6. Legal and Regulatory Aspects
  7. General Prevention and Control Measures

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION
  1. Biological Aspects
  2. Physical and Chemical Aspects
  3. Social and Economic Aspects
  4. Environmental Response and Recovery
  5. Baseline and Environmental Impact Studies
  6. Legal and Regulatory Aspects
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D. FATE OF OIL IN THE ENVIRONMENT
  1. Biodegradation
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  3. Models, Simulations, and Predictions
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INTRODUCTION

OIL POLLUTION ABSTRACTS is a quarterly abstracting series which reviews scientific and technical publications and research projects to inform readers about current developments in the field of oil pollution. This issue contains summaries of articles, reports, books, conference papers, patents, and other literature relating to oil pollution published after 1975 (Section I), and summaries of current research projects (Section II). Subject keyword, author, and patent indexes are included.

Subject coverage encompasses terrestrial and aquatic oil pollution, with emphasis on the marine environment. The citations in Section I are divided into nine major categories which are further divided into thirty-seven specific subcategories (see p. v). A list of periodicals reviewed in preparing this series appears in Appendix A.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and information on the current status and publications resulting from the projects.

Each entry is provided with several descriptive terms selected from a controlled master list of approximately 400 keywords (see p. 147), and, if necessary, one or more specific free-language terms prefaced by an asterisk (*). The groups of keywords for each entry are alphabetically permuted by computer to form the Subject Keyword Index, permitting rapid access to every entry. OIL POLLUTION ABSTRACTS ordering information is included as Appendix B.

OIL POLLUTION ABSTRACTS*

Issues currently available, in press, or in preparation

*This series was formerly entitled:
OIL POLLUTION REPORTS (1978: Vol. 5, No. 2 to Vol. 5, No. 4)
OIL SPILL AND OIL POLLUTION REPORTS (1974 to 1978: Vol. 5, No. 1)

	DATES COVERED	REPORT NUMBER
1974	July 74 - Oct. 74	EPA-670/2-75-003
1975	Nov. 74 - Feb. 75	EPA-670/2-75-044
1975	Feb. 75 - Apr. 75	EPA-670/2-75-059
1975	May 75 - July 75	EPA-600/2-76-129
1975	Aug. 75 - Oct. 75	EPA-600/2-76-113
1976	Nov. 75 - Jan. 76	EPA-600/2-76-185
1976	Feb. 76 - Apr. 76	EPA-600/2-76-215
1976	May 76 - July 76	EPA-600/2-76-266
1976	Aug. 76 - Oct. 76	EPA-600/2-77-037
1977	Nov. 76 - Jan. 77	EPA-600/2-77-075
1977	Feb. 77 - Apr. 77	EPA-600/2-77-111
1977	May 77 - July 77	EPA-600/2-77-243
1977	Aug. 77 - Oct. 77	EPA-660/2-78-005
Vol. 5, No. 1	Nov. 77 - Jan. 78	EPA-600/2-78-071
Vol. 5, No. 2	Feb. 78 - May 78	EPA-600/7-78-160
Vol. 5, No. 3	June 78 - Sep. 78	EPA-600/7-78-218
Vol. 5, No. 4	Oct. 78 - Dec. 78	EPA-600/7-79-040
Vol. 6, No. 1	Jan. 79 - Mar. 79	EPA-600/7-79-160
Vol. 6, No. 2	Apr. 79 - June 79	Submitted 7/79
Vol. 6, No. 3	July 79 - Sep. 79	Submitted 10/79
Vol. 6, No. 4	Oct. 79 - Dec. 79	Submitted 1/80

For complete ordering information, please see Appendix B.

ABBREVIATIONS/ACRONYMS

atm	atmosphere
bbl	barrel
C	carbon
°C	degrees Centigrade
cm	centimeter
COW	crude oil washing
DWP	deepwater port
dwt	dead weight ton
EIS	environmental impact statement
°F	degrees Fahrenheit
ft	foot
g	gram
gal	gallon
GC	gas chromatography
GLC	gas-liquid chromatography
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
ha	hectare
hr	hour
in	inch
IR	infrared
kg	kilogram
km	kilometer
kn	knot
L	liter
lb	pound
LC	liquid chromatography
LD	lethal dose
LNG	liquefied natural gas
LOT	load on top
LPG	liquefied petroleum gas
m	meter
mg	milligram
mi	mile
min	minute

ml	milliliter
mm	millimeter
MS	mass spectrometry
N	nitrogen
N.A.	not available
nm	nautical mile
O	oxygen
OCS	outer continental shelf
OPA	OIL POLLUTION ABSTRACTS
oz	ounce
PAH	polycyclic aromatic hydrocarbon
pH	the negative log of the H ion concentration
ppb	parts per billion
ppm	parts per million
SBT	segregated ballast tank
sp.	species
TLC	thin-layer chromatography
UK	United Kingdom
US	United States
USSR	Union of Soviet Socialist Republics
UV	ultraviolet
VLCC	very large crude carrier
vs	versus
WSF	water soluble fraction
wt	weight
yr	year
μ	micron
g	microgram
%	percent
/	per
~	approximately
>	greater than
<	less than

ABBREVIATIONS/ACRONYMS (continued)

API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
DOE	Department of Energy
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FAO	Food and Agricultural Organization
FEA	Federal Energy Administration
IMCO	International Maritime Consultative Organization
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
OHMSETT	Oil and Hazardous Materials Simulated Environmental Test Tank
SSIE	Smithsonian Science Information Exchange
UN	United Nations
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
USN	United States Navy

SECTION I

REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. Detection and Monitoring

79D-1117
DETERMINATION OF MINERAL OILS IN SURFACE WATERS AND SEDIMENTS [in Italian]
Ariati, L., and P. Berbenni. 1979.
Inquinamento 21(2):31-33.

Sampling, Chemical analysis, Freshwater, Soils, Sediments

Oils in soils and sediments are detected by dehydrating the samples with anhydrous Na_2SO_4 and extracting with CCl_4. Oils in water are extracted by ether, then dehydrated, the solvent distilled, and the residue weighed.

[from Chemical Abstracts 91(6):#44355c. 1979]

79D-1118
BIOMONITORING - A FINAL METHOD TO MEASURE POLLUTION ABATEMENT
Bender, E.S., and P.F. Robinson. 1978.
Report AD-A056 410. 3 p.

Detection, Monitoring, Bioindicators, Pollution prevention, *Biomonitoring

Summary not available.

[from Government Reports Announcements 78(21):83. #AD-A056 410. 1978]

79D-1119
APPARATUS FOR MEASURING THE OIL CONTENT IN WATER
Berthold, R., and H.D. Hess. 1978.
German patent application 2,751,738

Analytical techniques, Concentrations, Detection, Patent, *Oil-in-water, *Fluorescence

The apparatus has a UV light source and two light conducting rods. The UV light passes through one of the rods into the sample where it excites fluorescence in oil present. A detector at the end of the second light conducting rod measures the UV fluorescence.

[from Chemical Abstracts 91(8):#59341u. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1120
A SYSTEMATIC APPROACH TO AQUATIC CONTAMINANT SURVEILLANCE
Craig, G.R., K. Suns, D.L. Wells, C.A. Curry, and T. Lagan. 1978.
Canada, Fisheries and Marine Service, Technical Report 818:54-64.

Monitoring, Wastewaters, Contamination, Toxicity, Analytical techniques, Great Lakes

Contaminants and contaminant sources were identified in the Lower Great Lakes. Toxicity studies were then conducted either in the laboratory or by establishing an exposure facility at the point of contaminant discharge to the lake. [possibly oil pollution related]

[from Chemical Abstracts 91(1):#987f. 1979]

79D-1121
DETERMINATION OF AROMATIC HYDROCARBONS IN PPM BY UV SPECTROSCOPY
Dagga, F.A., and Z. Hameed. 1977.
Annual Research Report - Kuwait Institute of Scientific Research. p. 66-67.

Chemical analysis, Detection, Concentrations, Aromatic hydrocarbons, Spectroscopy

"Aromatic hydrocarbons were detected in crude oil samples in heptane at 210-300 nm. The absorbances for the crude oils were measured and read directly from the chart. The technique was useful in determining oil pollutants in ppm concentrations."

[from Chemical Abstracts 91(6):#41632e. 1979]

79D-1122
DETERMINATION OF AROMATIC HYDROCARBONS IN SEAWATER
Dawson, R., and M. Ehrhardt. 1976.
Methods of Seawater Analysis. K. Grasshoff. Weinheim/New York, Verlag Chemie, 1976. p. 227-234.

Detection, Aromatic hydrocarbons, Seawater

Summary not available.[possibly oil pollution related]

[from Marine Pollution Research Titles 5(3):#415. 1978]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1123
ENERGY-RELATED POLLUTANTS IN THE ENVIRONMENT: USE OF SHORT-TERM TEST FOR MUTAGENICITY IN THE ISOLATION AND IDENTIFICATION OF BIOHAZARDS
Epler, J.L., F.W. Larimer, T.K. Rao, C.E. Nix, and T. Ho. 1978.
EHP, Environmental Health Perspectives, Vol. 27:45-50.

Contamination, Mutagens, Biological effects, Detection, Analytical techniques

"A review with 41 references." [possibly oil pollution related]

[from Chemical Abstracts 91(1):#848m. 1979]

79D-1124
THE SULLOM VOE MONITORING PROGRAMME
Foxton, P. 1979.
The Marine Environment of Sullom Voe and the Implications of Oil Development, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 22. Abstract.

Hydrocarbons, Monitoring, Distribution, Concentrations, Marshes, Birds, Scotland, *Sullom Voe

Several elements of the monitoring program are discussed including regular surveys of hydrocarbon and heavy metal levels in marine sediments and animal tissues, surveys of benthic, rocky shore, soft shore, and salt marsh habitats, atmospheric monitoring, and a special project on ornithological monitoring. The procedure for results assessment and annual reporting is discussed.

79D-1125
DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN REFINERY EFFLUENTS [in German]
German Society for Petroleum Sciences and Coal Chemistry. 1978.
Berichte-Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie 142. 50 p.

PAH, Hydrocarbons, Extraction, Detection, Wastewaters, Refineries, Analytical techniques, *Fluorometry

A thin-layer fluorometric method following extraction with cyclohexene is used for the title determination. An alternative UV method is described.

[from Chemical Abstracts 91(2):#9078t. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1126
APPARATUS FOR AUTOMATIC IR MEASUREMENT OF THE HYDROCARBON CONTENT OF AN AQUEOUS EFFLUENT
Guiges, F. 1977.
French Patent Application 2,351,404

Hydrocarbons, Detection, Wastewaters, *IR

An IR spectrophotometer is used to automatically measure the hydrocarbon content of an aqueous effluent. The hydrocarbons are separated using CCl_4, an automatic reactor, and a chromatography column.

[from Chemical Abstracts 89(22):#185518d. 1978]

79D-1127
BIOINDICATORS OF POLLUTION. VOLUME 2. (A BIBLIOGRAPHY WITH ABSTRACTS)
Harrison, E.A. 1978.
Report NTIS/PS-78/1143, 248 p. Report for November 77 - October 78. (Supersedes NTIS/PS-77/0993, NTIS/PS-76/0868, NTIS/PS-75/796, and NTIS/PS-75/024.)

Detection, Bioindicators, Microorganisms, Plants, Animals, Fish, Bibliographies

With 43 new abstracts to the previous edition this bibliography is concerned with the use of microorganisms, animals, plants, and fish for air and water pollution detection. [possibly oil pollution related]

[from Government Reports Announcements 78(25):77. #NTIS/PS-78/1143. 1978]

79D-1128
DETERMINATION OF OIL IN WATER BY ORGANIC CARBON ANALYSIS
Hearst, P.J. 1979.
Report TN-1541. 34 p.

Analytical techniques, Detection, Concentrations, *Oil-in-water

"A method was investigated for determination of oil in water by establishing the organic content attributable to the oil and by converting this value to the oil content. Samples were homogenized with the aid of an emulsifier, and a correction was made for the carbon contributed by the emulsifier."

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1129
APPLICATION OF INFRARED SPECTROPHOTOMETRY TO THE DETERMINATION OF HYDROCARBONS AND PHENOLIC COMPOUNDS IN SEAWATER [English summary]
Kantin, R. 1977.
Tethys 7(4):413-418.

Detection, Concentrations, Hydrocarbons, Analytical techniques, Spectrometry, Seawater

Described are the principles and method of operation for the determination of hydrocarbons and phenolic compounds using infrared spectrophotometry. Preliminary results are presented for sea water concentrations around Marseilles.

79D-1130
THIN-LAYER FLUOROMETRIC DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN VEHICLE EXHAUST CONDENSATE, MINERAL OIL PRODUCTS AND WASTE WATER
Kaschani, D.T., and R. Reiter. 1978.
Fresenius' Zeitschrift fuer Analytische Chemie 292 (2):141.

Analytical techniques, PAH, Wastewaters, *Fluorometry

The method allows detection of several PAHs with good repeatability.

[from Chemical Abstracts 89(24):199986s. 1978]

79D-1131
Chironomus LARVAE - INDICATOR ORGANISMS FOR PETROLEUM AND/OR HEAVY METAL POLLUTION. A LITERATURE SURVEY [in Swedish]
Landahl, C.C., and L. Lindestrom. 1978.
Institutet foer Vatten-och Luftvardsforskning B, B455. 10 p.

Bioindicators, Marine organisms, **Chironomus* larvae

Observations in Swedish waters indicate that the larvae of Chironomidae can be used as indicators of pollution by the title compounds.

[from Chemical Abstracts 89(26):#220537h. 1978]

79D-1132
CHRONOLOGY OF EVENTS AND OIL SLICKS FROM THE *ARGO MERCHANT*
Mattson, J.S. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 15-18.

Oil slicks, Monitoring, Behavior, Movement, *Argo Merchant* spill

A. OIL POLLUTION DETECTION AND EVALUATION

The operational and scientific events associated with the *Argo Merchant* oil spill are presented in the context of the condition of the vessel and the location of the spilled oil. A series of maps indicates the movement of the slick from 17 December 1976 to 25 December 1976.

79D-1133
DETERMINATION OF VOLATILE CONSTITUENTS CONTAINED IN SOILS, SPECIFICALLY PETROLEUM HYDROCARBONS
Moeller, F., and H.G. Paesler. 1978.
East German Patent 132,211

Hydrocarbons, Analytical techniques, Soil, Equipment, Design-engineering, Patent, *Volatilization

The title determination involves heating samples of undisturbed soil to 60°, passing purified air through the samples to remove pollutants, and detecting hydrocarbons in the air by an indicator method.

[from Chemical Abstracts 91(3):#19032n. 1979]

79D-1134
APPARATUS FOR DETERMINING VOLATILE CONSTITUENTS CONTAINED IN SOILS, SPECIFICALLY PETROLEUM HYDROCARBONS
Moeller, F., H.G. Paesler, W. Hartwig, and G. Wermke. 1978.
East German Patent 132,212

Hydrocarbons, Analytical techniques, Soil, Equipment, Design-engineering, Patent, Detection

The title apparatus is described and a scheme for its construction is presented. The sample is heated in the apparatus and the volatiles are removed by an air current.

[from Chemical Abstracts 91(3):#19031m. 1979]

79D-1135
DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN AQUEOUS SAMPLES BY REVERSED-PHASE PERFORMANCE LIQUID CHROMATOGRAPHY
Ogan, K., E. Katz, and W. Slavin. 1979.
Analytical Chemistry 51(8):1315-1320.

Sampling, Chemical analysis, PAH, Chromatography, Detection, Concentrations,

An analytical method for detecting 16 PAHs in aquatic samples is described. These PAH types are of special environmental concern because 15 of the 16 are on the EPA Priority Pollutant list. In several cases the method is sensitive to levels of <10 nanograms/L in the original samples. [possibly oil pollution related]

[from Chemical Abstracts 91(6):#44322q. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1136
DENSITOMETER FOR DETERMINING THE OIL CONTENT OF LIQUIDS
Okada, M., T. Sato, T. Okuno, and M. Shima. 1978.
German Patent Application 2,715,118

Sampling, Detection, Waste oil, Concentrations

Oil is detected in the presence of suspended solids by subjecting the flowing sample to two intensities of ultrasonic emulsification and determining the turbidity optically. The turbidity difference resulting from the different emulsification intensities is a measure of the oil concentration.

[from Chemical Abstracts 89(21):#181583y. 1978]

79D-1137
DETERMINATION OF OIL CONCENTRATION IN WASTEWATERS BY OPTICAL METHOD
Otsuka, H., and S. Arisaka. 1978.
Japanese Patent Application 78 87,793

Wastewaters, Detection, Concentrations, Tankers, Patent, *Optical method

Oil-containing wastewater is homogenized by air and the oil content determined optically by comparing with a standard mixture. The method may be applied to bilge waters.

[from Chemical Abstracts 89(26):#220529g. 1978]

79D-1138
POLLUTION MONITORING--NEEDS AND APPROACHES
Ramanathan, N.L. 1978.
Electronics - Information and Planning 5(7):541-544.

Monitoring, Wastewater treatment, Rivers, Equipment, Design-engineering, Chemical analysis, India

Discussed are existing pollution monitoring systems, alternative approaches, the use of monitoring data, the need for design flexibility of equipment, and marketing potential for pollution monitoring systems in India. [possibly oil pollution related]

79D-1139
SENSITIZED FLUORESCENCE FOR THE DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS
Smith, E.M., and L. Levins. 1978.
Report EPA/600/7-78/182, Contract EPA-68-02-2150. 33 p.

Detection, PAH, Analytical techniques, *Fluorescence

This report describes a fluorescent spot test devised for PAH detection based on the sensitization of the inherent fluorescence of PAH compounds. The method has been shown to be specific with minimum interference from other compounds, and can be used to estimate the general levels (factors of 10) of PAHs in samples to aid in decisions for more specific analysis. [possibly oil pollution related]

[from Government Reports Announcements 79(2):76. #PB-287 181. 1979]

79D-1140
OIL POLLUTION DETECTION AND SENSING. VOLUME 2 (A BIBLIOGRAPHY WITH ABSTRACTS)
Smith, M.F. 1978.
Report NTIS/PS-78/1076. 140 p. Report for 1976-Aug. 1978. (Supersedes NTIS/PS-77/0934, NTIS/PS-76/0701, and NTIS/PS-75/595.)

Sampling, Remote sensing, Detection, Analytical techniques, Oil spills, Wastewaters, Bibliographies

"Citations of research on sampling, detection, and chemical analysis of oil in water are presented. Studies on remote sensing principally using radar, ocean wave damping, and infrared detection are included. The classification, pattern recognition, luminescence, gas chromatography, and neutron activation analysis of oils are reported in these abstracts. The majority of these citations concern oil spills, but studies on oil wastes, industrial wastes, bilge water, and sewage are also covered. (This updated bibliography contains 135 abstracts, 33 of which are new entries to the previous edition.)"

[from Government Reports Announcements 78(25):176. #NTIS/PS-78/1076. 1978]

2. Remote Sensing

79D-1141
REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT (A BIBLIOGRAPHY WITH ABSTRACTS)
Hundemann, A.S. 1978.
Report NTIS/PS-78/0789. 163 p. Report for 1964-July 1978. (Supersedes NTIS/PS-76/0674, and updates NTIS/PS-76/0500.)

Remote sensing, Bibliographies, Oil spills, Detection, Dispersion, Fate, Estuaries

Application of remote sensing to water and other types of pollution is discussed. Topic areas include characteristics of pollutant transport, remote sensing of estuarine problems, and monitoring of oil spills. This updated bibliography contains 156 abstracts, 23 of which are new.

[from Government Reports Announcements 78(20):203. #NTIS/PS-78/0789. 1978]

79D-1142
REMOTE SENSING FOR THE CONTROL OF MARINE POLLUTION. PRELIMINARY INVENTORY OF AVAILABLE TECHNOLOGIES
Massin, J-M. 1978.
Report NATO/CCMS-78. 343 p.

Remote sensing, Hydrocarbons, Oil spills, Detection, Monitoring, Equipment, Analytical techniques

This manual is an inventory of available techniques, instrumentation and research centers in the field of remote sensing of the marine environment for detection of pollution. Emphasis is placed on oil spills and hydrocarbon pollution and its detection. Satellite technology is not included in this report.

[from Government Reports Announcements 79(1):164. #PB-287 317. 1979]

3. Sampling and Analysis

79D-1143
HYDROCARBON CHEMISTRY OF THE WATER COLUMN OF GEORGES BANK AND NANTUCKET SHOALS, FEBRUARY-NOVEMBER 1977
Boem, P.D., G. Perry, and D. Fiest. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 58-64.

Analytical techniques, Chemical analysis, Hydrocarbons, Chromatography, Georges Bank, *Argo Merchant* spill

Described in the title article are analysis procedures carried out on large volume water samples (50-90 L) collected in mid-February, May, August, and September of 1977 at 12 stations in the Georges Bank/Nantucket Shoals area. Near surface and bottom samples were filtered on-board and the filtrate extracted by a countercurrent liquid-liquid extractor. Hydrocarbon compositions were determined by glass capillary gas chromatography and combined GC/MS. Results are discussed.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1144

CHEMICAL ANALYSIS OF DISPERSED OIL IN THE WATER COLUMN

Brown, C.W., P.F. Lynch, and M. Ahmadjian. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walters (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 188-202. ASTM Special Technical Publication 659.

Chemical analysis, Hydrocarbons, Dispersion, Dispersants, Concentrations

Water column samples from treated and untreated experimental spills into 6 m-deep test tanks were analyzed for hydrocarbons. The concentration of oil in the water just beneath the surface was initially 27 times greater when a dispersant was used; however, during a 3-day experiment, the amount of oil in the water column decreased significantly in both the treated and untreated cases. When a dispersant was used, the maximum hydrocarbon concentration in the water column gradually moved toward the bottom of the tank.

79D-1145

OIL DROPLET MEASUREMENTS MADE IN THE WAKE OF THE ARGO MERCHANT

Carnillon, P. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January, 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 43-47.

Sampling, Physical aspects, Analytical techniques, Argo Merchant spill

The title article discusses the methods and results of experiments carried out to determine the size of entrained oil particles following the Argo Merchant spill. Three general droplet structures are identified and described.

79D-1146

DISTINGUISHING BIOGENIC HYDROCARBONS FROM THOSE OF PETROLEUM ORIGIN IN WATER AND SOLID SAMPLES [in German]

Erdmann, W., W. Giger, H. Hellmann, C. De Lorent, et al. 1978.

Hydrochemische und Hydrogeologische Mitteilungen 3 (Untersuchung Beurteilung Wassers Nutzungszyklus):113-145.

Sampling, Chemical analysis, Detection, Hydrocarbons, Biogenic hydrocarbons

"Methods for detecting hydrocarbons in water and solids, criteria for distinguishing biogenic from petroleum hydrocarbons, and their use in characterizing various samples (groundwater, wellwater, oil spills, suspended matter, street dust, clarifier sludge, recent sediments) are described."

[from Chemical Abstracts 91(6):#44313n. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1147
MANUAL FOR THE DIFFERENTIATION OF BIOGENIC AND PETROLEUM HYDROCARBONS [in German]
Erdmann, W., W. Giger, H. Hellmann, W. Koelle, et al. 1977.
Berichte - Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlenchemie, Vol. 150:44 p.

Wastewaters, Sediments, Analytical techniques, Hydrocarbons, Biogenic hydrocarbons, Manuals

"Criteria and analytical methods for distinguishing biogenic hydrocarbons from petroleum hydrocarbons in natural and wastewaters, oily deposits, sediments, dust, etc. are described."

[from Chemical Abstracts 89(22):#181981b. 1978]

79D-1148
ENRICHMENT AND ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN WATER [in German]
Faltusz, E. 1979.
Fresenius' Zeitschrift fuer Analytische Chemie 294(5):385-390.

PAH, Analytical techniques, Chromatography

PAHs are enriched by precipitating $Mg(OH)_2$ in the sample, centrifuging, dissolving the solids in NH_4Cl, extracting the organic compounds with cyclohexane, and analyzing by GC using electron capture detection. The method is compared with rapid liquid extraction.

[from Chemical Abstracts 91(2):9280c. 1979]

79D-1149
PETROLEUM
Fraser, J.M., F.C. Trusell, N.H. Fick, N.P.T. Bradley, et al. 1979.
Analytical Chemistry 51(5):211R.

Petroleum products, Crude oil, Chemical analysis, Source identification, Analytical techniques

A series of articles is presented, reviewing the application of analytical techniques in the petroleum industry. Included are discussions of crude oil analysis, "fingerprinting," fuels, lubricants, oils and greases, hydrocarbons and metals in oils. Various works on methods of detection and analysis are detailed.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1150
COMPARISON OF THIN-LAYER AND COLUMN CHROMATOGRAPHY FOR SEPARATION OF SEDIMENTARY HYDROCARBONS
Gearing, J.N., P.J. Gearing, T.F. Lytle, and J.S. Lytle. 1978.
Analytical Chemistry 50(13):1833-1836.

Chromatography, Sediments, Hydrocarbons, Analytical techniques, *TLC, *Column chromatography

The title comparison suggests that column and thin-layer chromatography may be used interchangeably for purification of sedimentary hydrocarbon extracts.

79D-1151
CHARACTERIZATION OF PETROLEUM OILS BY HIGH SPEED GEL PERMEATION CHROMATOGRAPHY WITH ULTRA-VIOLET SPECTROMETRIC DETECTOR [in Japanese]
Higashi, K., and K. Hagiwara. 1978.
Osaka Kogyo Gijutsu Shikensho Kiho 29(3):249-255.

Sampling, Analytical techniques, Chromatography, Crude oil, Petroleum products

Oil samples were diluted with THF and analyzed by the title method with THF as eluent. The UV absorption of the eluate was recorded at 240-400 nm, and the chromatograms for several crude oils and petroleum products were evaluated. The oils could be classified into two groups by measuring the chromatograms at 254 nm, and each product could be discriminated by measuring retention time by gel or gas chromatography. Crude oils with similar profiles at 254 nm can be differentiated by measuring at 280 nm.

[from Chemical Abstracts 91(4):#23493f. 1979]

79D-1152
CHARACTERIZATION OF TAR BALLS BY GAS CHROMATOGRAPHY [in Japanese]
Higashi, K., C. Igarashi, and K. Hagiwara. 1978.
Osaka Kogyo Gijutsu Shikensho Kiho 29(4):360-363.

Sampling, Tar, Japan, Chromatography, Analytical techniques, Source identification

Tar balls collected from the ocean around Japan were characterized by gas chromatography with a Silicone SE-30 3%-Chromosorb W column. The chromatograms were compared with those of 8 crude oils. Petroleum was identified by the characteristic n-paraffins.

[from Chemical Abstracts 91(4):#27007y. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1153
DISCRIMINATION OF SPILLED OILS BY HIGH SPEED GEL PERMEATION CHROMATOGRAPHY WITH AN ULTRAVIOLET SPECTROMETRIC DETECTOR
Higashi, K., and K. Hagiwara. 1978.
Fresenius' Zeitschrift fuer Analytische Chemie 292(2):108-112.

Sampling, Chemical analysis, Chromatography, Spectrometry, Weathering

The title process is described. The discrimination capability was enhanced by comparing profiles of the chromatograms at several detection wavelengths. The change of profiles with weathering of the oils was small.

[from Chemical Abstracts 89(24):#199933x. 1978]

79D-1154
A COMPARISON OF *ARGO MERCHANT* OIL AND SEDIMENT HYDROCARBONS FROM NANTUCKET SHOALS
Hoffman, E.J., and J.G. Quinn. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 80-88.

Analytical techniques, Hydrocarbons, Sediments, Chromatography, Movement, *Argo Merchant* spill

Surface sediment samples collected from the *Argo Merchant* wreck site were analyzed for hydrocarbon content by gas chromatography. Findings indicated that significant hydrocarbon contamination extended at most 3-4 km from the wreck in a SE direction. Analysis of sediment grab subsections revealed no clear trend in hydrocarbon contamination as a function of depth.

79D-1155
WATER SOLUBLE FRACTION OF *ARGO MERCHANT* CARGO
Jadamec, J.R. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 53-57.

WSF, Concentrations, Analytical techniques, Sampling, *Argo Merchant* spill, *Fluorescence spectroscopy

A series of water column samples was collected adjacent to the wreck site to determine the extent and level of hydrocarbons entering the environment. Fluorescence spectroscopic analysis of the samples indicated that a physical-chemical fractionation occurred only with the lighter aromatic compounds. Concentrations decreased from a high of 340 ppb in late December 1976 to less than 20 ppb in February 1977.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1156
METHODS FOR ANALYSIS OF FOUL-SMELLING COMPONENTS AND HEAVY METALS IN FISH AND MOLLUSKS. I. RECOVERY OF HYDROCARBONS BY FREEZE DRYING
Kasano, K., M. Kusaka, and K. Yamashita. 1978.
A & R 16(9):385-390.

Chemical analysis, Aromatic hydrocarbons, Fish, Mollusks, Contamination, *Freeze drying

Foul-smelling hydrocarbons and other contaminants were recovered from homogenized tissue samples by freeze drying. The method used and the results obtained are detailed. Among the hydrocarbons isolated were tetra-, penta-, and hexadecane.

[from Chemical Abstracts 91(7):#54685z. 1979]

79D-1157
OIL POLLUTION IN KAOHSIUNG HARBOR [English summary]
Lain, J-L., C-L. Chen, and C-Y. Chung. 1977.
Journal of the Fisheries Society of Taiwan 5(2):73-84.

Hydrocarbons, Chemical analysis, Source identification, Contamination, Marine organisms, Harbors, *Taiwan

The state of oil pollution and water quality in Kaohsiung Harbor, Taiwan were studied. Results indicated that mineral oil is the major source of waste oil in the harbor, that shellfish contained high levels of hydrocarbons, and that 75% of the oil drifting on the water surface could be recovered by fractional distillation over 500° C.

79D-1158
CHARACTERIZATION OF CONFINED DISPOSAL AREA INFLUENT AND EFFLUENT PARTICULATE AND PETROLEUM FRACTIONS
Lu, J.C.S., and K.Y. Chen. 1978.
Report WES-TR-D-78-16, Contract DACW 39-76-C-0038. 187 p. Final Report.

Chemical analysis, Analytical techniques, Disposal, Hydrocarbons, Wastewaters

A detailed analysis of contaminants in influents and effluents from two confined dredged disposal areas near Mobile, Alabama and Detroit, Michigan is presented. Sample collection and testing procedures are detailed. Samples were analyzed for metals, nutrients, total carbon, organic carbon, chlorinated hydrocarbons, oil and grease and solids contents.

[from Government Reports Announcements 78(21):196. #AD-A056 371. 1978]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1159
HYDROCARBON PATTERNS IN SOME MARINE BIOTA AND SEDIMENTS FOLLOWING THE ARGO MERCHANT SPILL
MacLeod, W.D., Jr., M.Y. Uyeda, L.C. Thomas, and D.W. Brown. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 72-79.

Analytical techniques, Hydrocarbons, Sampling, Marine organisms, Sediments, Fish, Argo Merchant spill

Over 60 samples of marine biota or sediments collected after the Argo Merchant spill were analyzed by gas capillary chromatography, and GC patterns from the samples were compared to the corresponding patterns from the Argo Merchant cargo. Findings of analyses from cod, flounder, sediments, and other biota are presented and discussed.

79D-1160
THEORY OF AUTOMATIC ANALYTICAL METHODS. 15. OIL FRACTIONS [in Japanese]
Nishikawa, S. 1976.
Suishitsu Odaku no Jido Bunseki. T. Araki and A. Takahashi (eds.). Kyoto, Japan, Kagaku Dojin, 1976. p. 155-168.

Hydrocarbons, Analytical techniques, WSF

"A review with 5 references."

[from Chemical Abstracts 89(24):#203770m. 1978]

79D-1161
SOIL POLLUTION: SITUATION OF SOME AGRICULTURAL AND SEABOARD URBAN ZONES IN THE PROVINCE OF ROME [in Italian]
Sanna, M., N. Pelosi, C. Carocci, and S. De Vincenzi. 1979.
Unione Ital. Lab. Prov. 5(2):260-270.

Soil, Hydrocarbons, Beaches, Surfactants, Chemical analysis

The contents of heavy metals, mineral oil, and some chemicals are given for several agricultural soils around Rome. Data are also given on pollution of beach sand by oils and by anionic surfactants.

[from Chemical Abstracts 91(3):#14875e. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1162
ANALYSIS OF RARITAN BAY BOTTOM WATERS FOR POLYNUCLEAR AROMATIC HYDROCARBONS
Stainken, D., and U. Frank. 1979.
Bulletin of Environmental Contamination and Toxicology 22(4/5):480-487.

PAH, Analytical techniques, Spectroscopy, Bays, New York

Analyses of bottom water samples were performed using synchronous excitation (SE) of fluorescence spectroscopy. PAH content was confirmed by high pressure liquid chromatography and infrared spectroscopy following sample extraction with freon. The SE method was found to be superior to single wavelength excitation fluorescence methods because it yields spectra that are resolved according to the number of aromatic rings. The low concentrations and infrequent presence of PAHs in the bottom waters sampled suggest that much of the pollution in the bay is a surface phenomenon.

79D-1163
ANION ACTIVE SURFACTANTS. II. CONTAMINATION OF THE INLAND SEA OF JAPAN BY ANIONIC SURFACTANTS [in Japanese]
Yoshida, H., and R. Takeshita. 1978.
Eisei Kagaku 24(2):78-82.

Chemical analysis, Concentrations, Contamination, Surfactants, Biological effects, Fish, Japan

The methylene blue method was used in showing high concentrations of anionic surfactants in the eastern Inland Sea six months after Amberlite XAD-2 columns were used to disperse an oil spill in the area. The effect of the surfactants on fish was not great.

[from Chemical Abstracts 89(24):#203844p. 1978]

79D-1164
DETERMINATION OF THE CHEMICAL COMPOSITION OF PETROLEUM OILS BY CONTINUOUS TWO-STAGE LIQUID CHROMATOGRAPHIC AND MASS SPECTROMETRIC METHODS [in Russian]
Zakupra, V.A.,V. Kozack, E.V. Kolosova, and N.I. Vykhrestyuk. 1979.
Khimiya i Tekhnologiya Topliv i Masel 3:58-63.

Analytical techniques, Petroleum products, Source identification

The title analytical methods were used to determine the composition of ASVI and DSII oils. [possibly oil pollution related]

[from Chemical Abstracts 91(2):#7206j. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

4. Source Identification

79D-1165
WHERE THE ARGO MERCHANT OIL DIDN'T GO
Brown, C.W., P.F. Lynch, and M. Ahmadjian. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 65-71.

Source identification, Tar, Beaches, *Argo Merchant* spill, Massachusetts, Rhode Island

Weathered tar balls found on Massachusetts and Rhode Island beaches were analyzed in an attempt to determine their origin. The probabilities that the tar balls came from the same source, that they came from the *Argo Merchant*, that they came from the lost tanker Grand Zenith, or that they came from some other source have been determined and are discussed in the report.

79D-1166
CLASSIFICATION OF CRUDE OIL GAS CHROMATOGRAMS BY PATTERN RECOGNITION TECHNIQUES
Clark, H.A., and P.C. Jurs. 1979.
Analytical Chemistry 51(6):616.

Source identification, Crude oil, Chemical analysis, Chromatography

Pattern recognition methods are described by which crude oils can be classified according to their chromatograms. Four oils were represented by gas chromatograms taken before and after weathering. "Predictive abilities as high as 100% were obtained for some of the partitions of the data set."

79D-1167
THE CASE OF THE TAINTED MULLET
Connell, D.W. 1979.
Sea Frontiers 25(2):115-119.

Source identification, Contamination, Biological effects, Fish, Australia

A chronology of events leading to the discovery of the source of a "petroleum taint" in the sea mullet, *Mugil cephalus*, fishery in South Queensland, Australia is presented. In late 1968 the Fish Board initiated an investigation which eventually tracked down the source to a sewer discharge located on the Brisbane river. The incident resulted in new and stricter standards for sewer plant effluent.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1168
THE ORIGIN AND FATE OF HYDROCARBONS IN SULLOM VOE
Davies, J.M., R. Johnston, and K. Whittle. 1979.
The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Environmental Advisory Group, 1979. p. 11. Abstract.

Source identification, Hydrocarbons, Oil terminals, Distribution, Sediments, Fate, Scotland, *Sullom Voe

Petroleum hydrocarbons in the Sullom Voe environment are attributed to accidental and operational inputs. Two methods are used to estimate accidental inputs, one by analogy with world-wide averages and the other by analogy with other oil terminals. Petroleum hydrocarbon inputs are placed in the context of the natural hydrocarbons present, and their distribution and fate in the water column and sediments are considered.

79D-1169
THE ANALYSIS OF HYDROCARBONS AS INDICATORS OF POLLUTION
Douglas, A.G. 1979.
The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18, 19 April 1979. Oban, Scotland, Shetland Oil Terminal Environmental Advisory Group, 1979. p. 10. Abstract.

Source identification, Analytical techniques, GC/MS, Hydrocarbons, Sediments, Weathering, Detection

The title paper outlines methods used for analyzing polluted sediments for a number of n-alkanes, with the identification of oil spills being a major objective. For the purposes of computerized GC/MS analysis, the relative stereochemistry of some of the carbon atoms in steranes and triteranes plays an important part in the recognition of "matured" or crude oil alkanes.

79D-1170
AN ATLAS OF GAS CHROMATOGRAMS OF OILS USING DUAL FLAME-IONIZATION AND NITROGEN PHOSPHORUS DETECTORS
Frame, G.M., D.C. Carmody, and G.A. Flanigan. 1978.
Report CGR/DC-3/78, USCG-D-19-78. 57 p.

Source identification, Analytical techniques, Detection, Chromatograpy, Manuals

The title report details experimental techniques for using a thermionic nitrogen phosphorus detector (NPD) for gas chromatographic (GC) "fingerprinting" of petroleum and synthetic oils. An alumina column chromatography method is described and NPD detector GC curves of over 70 petroleum crudes and distillates run on a 50-foot Dexsil-300 SCOT column are reproduced to form a reference atlas.

[from Government Reports Announcements 78(18):209. #AD-A054 966. 1978]

79D-1171
THE USE OF CARBON AND SULFUR ISOTOPIC RATIOS AND TOTAL SULFUR CONTENT FOR IDENTIFYING THE ORIGIN OF BEACH TARS IN SANTA MONICA BAY, CALIFORNIA
Hartman, B.A. 1978.
Report USC/SG/TD-02-78, NOAA 78082804, Grant NOAA-04-6-158-4418. 113 p.
Master's thesis.

Source identification, Tar, Analytical techniques, Natural seepage, Bays, Weathering, California, *Santa Monica Bay

Carbon and sulfur isotopic ratios and total sulfur content are evaluated for use as chemical fingerprints for highly weathered petroleum. Analysis is confined strictly to the asphaltene fraction. Results suggest that 51% of the tars in Santa Monica Bay are from natural seeps at Coal Oil Point, 31% are from natural seepage in Santa Monica Bay, and 18% are from unknown sources.

[from Government Reports Announcements 79(1):85. #PB-286 780. 1979]

79D-1172
FINGERPRINTING OF CRUDE OIL
Jones, K. 1978.
Int. Environ. Saf., Dec:26-27.

Source identification, Fuel oil, Crude oil, Analytical techniques

The types and limitations of methods used for identifying fuel oil or petroleum spilled at sea are discussed.

[from Chemical Abstracts 91(4):#23504k. 1979]

79D-1173
DETERMINATION OF TOTAL ORGANIC NITROGEN AND ORGANOMETALLIC NICKEL IN OIL, SEDIMENTS AND MARINE PRODUCTS
Nakamura, A., and T. Kashimoto. 1979.
Bulletin of Environmental Contamination and Toxicology 22(3):345-349.

Source identification, Analytical techniques, Contamination, *Ni/N index

A digital nitrogen analyzer using a chemiluminescence detection method was used for total organic nitrogen determination in the title compounds. Organic nickel was measured with respect to porphirins by flameless atomic absorption spectrometry, and the relation between nitrogen content and organometallic nickel was evaluated. The Ni/N indices may be used to clarify fingerprints of oil obtained from contaminated samples.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1174

A STUDY ON THE IDENTIFICATION METHODS FOR WATERBORNE OIL. PART I. THE PREVIOUS MANAGEMENT OF WATERBORNE OIL AND THE CHANGE OF ITS GENERAL PROPERTIES [in Japanese]
Ogawa, T. 1977.
Kaijo Hoan Daigakko Kenky Hokoku, Dai-2-Bu23(1-2, Sect. 2):55-70.

Source identification, Analytical techniques, Oil spills

Measurements of various elements were used for identification of oil spills on water.

[from Chemical Abstracts 89(22):#185658z. 1978]

B. OIL POLLUTION PREVENTION AND CONTROL

1. Containment

79D-1175
GELATINIZATION AGENT
Ajinomoto Co., Inc. 1979.
Kawasaki, Japan, Ajinomoto Co., Inc., 1979. 18 p.

Spill containment, Pollution control, Spill response, Japan, *Gelatinization

This booklet reviews oil spill accidents and preventive measures taken in Japan, from 1972 to 1977, and presents a description of the properties and application methods for a new gelatinization agent for oil spill treatment. The gelatinization agent is biodegradable, has low toxicity, and is considered environmentally acceptable. Information is available from Central Research Laboratories, Ajinomoto Co., Inc., Suzuki-cho, Kawasaki-ku, Kawasaki 210, Japan.

79D-1176
METHODS OF OIL SPILL CONTROL FROM PORT WATER SURFACE [in Polish]
Badkowski, A.I. 1978.
Gospodarka Wodna 38(6):178-181.

Spill containment, Oil slicks, Spreading, Equipment

Methods presently used for the control of oil spill spreading are reviewed.

[from Chemical Abstracts 89(24):#203930p. 1978]

79D-1177
BOOM CONFIGURATION TESTS FOR CALM WATER, MEDIUM CURRENT OIL SPILL DIVERSION
Breslin, M.K. 1979.
Report EPA/600/2-78/186, Contract EPA-68-03-0490. 49 p.

Spill containment, Booms, Performance testing, Equipment, Design-engineering, EPA, *OHMSETT facility

The title test program was designed to determine the effects of boom angle, length and rigging configuration on diversion of oil floating on moving streams. Boom performance was photographically recorded. Results were evaluated in terms of the percentage of oil lost beneath the boom and away from the rear of the boom. A "nozzle-shaped" boom configuration achieved the best diversion at tow speeds above 1.0 m/s.

[from Government Reports Announcements 79(5):166. #PB-287 754. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1178
EVALUATION OF OIL SPILL BARRIERS AND DEPLOYMENT TECHNIQUES FOR THE ST. CLAIR-DETROIT RIVER SYSTEM
Environmental Protection Service, Canada. 1976.
Report EPS-4-EC-76-4. 29 p.

Product information, Equipment, Booms, Spill containment, Performance testing, Rivers, Canada, US, Contingency planning

As part of "Operation Preparedness," a joint US-Canadian marine Pollution Contingency Plan, twelve commercially available barriers were evaluated in river conditions, with currents ranging from 1.3 to 3.2 km/hr (0.8 to 1.8 knots). Barriers by Acme Products, American Marine Co., Bennett Pollution Controls, B.F. Goodrich Co., Hurum Marine, and Slickbar were tested, and the results are presented.

79D-1179
HYDRODYNAMICS OF DIVERSIONARY BOOMS
McCracken, W.E. 1978.
Report EPA/600/2-78/075, Contract EPA-68-03-0490. 57 p. Final report.

Spill containment, Equipment, Booms, Design-engineering, Simulations

A method is suggested for overcoming the failure of booms to contain oil in currents above 0.5 m/s. This involves use of the boom in a diversionary mode to move the oil into regions of low currents where containment and removal can be effected. Three-dimensional flow fields were examined visually, using dye and oil droplets with a towed underwater video system. Turbulence intensity was simultaneously photographed and measured with a hot-film anemometer.

[from Government Reports Announcements 78(18):289. #PB-281 282. 1978]

79D-1180
REUSABLE OIL ABSORBENT BILGE AND FUEL TANK OPENING PADS
Pedone, V.S.
US Patent 4,031,839

Sorbents, Absorption, Bilges, Pollution prevention, Equipment, Patent

The pads are designed for removing and absorbing oil from the bilge area and fuel tank filter area of a boat. They are composed of a synthetic woven material that absorbs the oil and retains it without leakage. The pads are formed into a ring which fits around the opening to prevent and absorb spillage during fuel transfer.

[from ERDA Energy Research Abstracts 2(21):5283. #50911. 1977]

B. OIL POLLUTION PREVENTION AND CONTROL

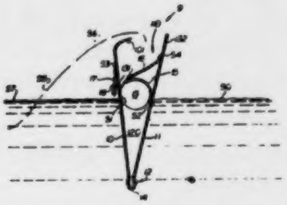
79D-1181
V-SHAPED OIL CONTAINMENT BOOM
Steen, J.W., J. Bennett, and I. McAllister. 1979.
US Patent 4,146,344

Spill containment, Booms, Equipment, Design-engineering, Patent

The boom has front and rear wall sections joined along their lower edges. It is provided with ballast and floats. A method for containing spills in ice-infested water is provided.

[from Petroleum Abstracts 19(28):#265,129. 1979]

4,146,344
V-SHAPED OIL CONTAINMENT BOOM
Jim W. Steen, Calgary; John Bennett, and Ian McAllister, both of Vancouver, all of Canada, assignors to Bennett Pollution Controls, Ltd., North Vancouver, Canada
Filed Jun. 6, 1977, Ser. No. 803,803
Int. Cl.² E02B *15/04*
U.S. Cl. 405—68 **9 Claims**



2. Cleanup and Removal

79D-1182
RUSSIAN OIL SKIMMER UNDERGOES TESTS (NEWS BRIEF)
Anon. 1979.
Conservation News 44(14):12.

Spill cleanup, Skimmers, Performance testing, Design-engineering, EPA, US, USSR, *OHMSETT facility

Under a bi-national agreement, the US and USSR are testing a new Russian design for picking up floating oil spills. The nearly 20 m (58 foot), 40 ton skimmer will be tested at the US EPA OHMSETT facility in New Jersey. A special propeller-tunnel arrangement permits the device to advance forward in water or to remain stationary and pull the oil into itself.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1183
OIL SORBENTS
Abrahamsson, T. 1979.
Swedish patent 405,981

Spill cleanup, Sorbents, Patent

"Oil sorbents consisting of small torn pieces of soft foamed plastics and a binder may also be fabricated as disk- or bowl-shaped filters useful for removing oil from oil-containing media."

[from Chemical Abstracts 91(8):#58344k. 1979]

79D-1184
APPARATUS FOR APPLICATION OF CHEMICAL DISPERSANTS ON OPEN SEA
Allen, T.E. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 266-276. ASTM Special Technical Publication 659.

Dispersants, Equipment, Performance testing, Pollution control, Design-engineering

A large durable boat sprayer system has been developed and tested for use on oil spills on the open sea. Designed for use on seagoing workboats, the system can be easily loaded onto the vessel, adapted to individual boats, and used in moderately rough seas. The system is designed to spray a path up to 18.3 m wide at a speed of 14.5 km/hr (8 knots), using a dispersant that requires low mixing energy in application.

79D-1185
OIL ADSORBING MATERIAL MADE FROM GRASS PEAT
Azuma, T., K. Hami, and K. Shima. 1979.
Japanese patent application 79 08,557

Adsorption, Sorbents, Plants, Patent, *Grass peat fibers

Grass peat is washed, crushed, heated under pressure, and the pressure is instantly reduced, to form fine grass peat fibers, which are then further processed into oil-adsorbing materials.

[from Chemical Abstracts 91(8):#61956s. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1186
WEAPONS AGAINST OIL POLLUTION
Bartlett, T. 1977.
Dock and Harbour Authority 58(680):114-116.

Spill cleanup, Spill removal, Booms, Skimmers, Dispersants, Sinking agents, Sorbents, Burning, IMCO, Manuals

Various means for combatting oil spills are discussed including dispersants, mechanical techniques, burning, sinking agents, and absorbents. Cleanup efforts following the wreck of the Torrey Canyon are briefly described. A list of "basic principles" for the prevention of oil pollution stemming from operational sources is cited from IMCO's Manual on Oil Pollution.

79D-1187
DISPERSANT USAGE FOR OFFSHORE OIL SPILLS
Coit, R.A. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 226-235. ASTM Special Technical Publication 659.

Dispersants, Offshore, Pollution control, Equipment, Guidelines, Contingency planning

Since 1967, US federal regulations have discouraged the use of dispersants to control oil spills. This paper summarizes the current concensus of an American Petroleum Institute task force on dispersant use. It concludes that new low-toxicity dispersants often are the best way of reducing or preventing environmental damage, that equipment is available for effective application, and that the National Contingency Plan needs revision to incorporate guidelines for dispersant usage when appropriate.

79D-1188
OIL POLLUTION - LOCAL EFFLUENT PROBLEMS
Clark, C.J. 1978.
Chemistry and Industry, No. 21:821-826.

Spill cleanup, Onshore, Wastewaters, Industries, Pollution prevention

Several alternatives available for oil cleanup following a pollution incident in an inland water course are discussed. These include cleanup by the offender with on-scene assistance and guidance from the water authority, and engaging the services of a firm specializing in oil decontamination.

[from Petroleum Abstracts 19(27):#264,931. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1189
A SYSTEM FOR THE APPLICATION OF DISPERSANTS TO THE PROBLEMS OF OIL SPILL CLEARANCE
Cormack, D., and J.A. Nichols. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 236-252. ASTM Special Technical Publication 659.

Pollution control, Dispersants, Equipment, UK, Contingency planning, *Application methods

This paper outlines the rationale for a dispersant approach to spill response, and details methods of application for ships, small vessels, and aircraft. Oil treatment rates and capabilities for aircraft and ships are tabulated, and data on the amounts of dispersant and equipment held in the UK for contingency planning are presented.

79D-1190
MICROBIAL DEGRADATION OF OIL IN SURFACE SOIL HORIZONS
De Borger, R., R. Van Loocke, A. Verlinde, and W. Verstraete. 1978.
Revue d'Ecologie et de Biologie du Sol 15(4):445-452.

Biodegradation, Soil, Spill cleanup, Biological treatment, Contamination

"Investigations were carried out to evaluate the environmental circumstances under which microbial cleanup is feasible and to define a practical procedure to decontaminate microbiologically surface soils polluted with oil." Nutritional C-N-P ratio, pH, temperature and aeration were found to affect oil breakdown.

[from Chemical Abstracts 91(3):#19022j. 1979]

79D-1191
FEDERAL VIEWPOINT ON USE AND POTENTIAL OF CHEMICAL OIL DISPERSANTS
Dorrler, J.S. 1977.
Proceedings of the Oil Spill Response Workshop. US Fish and Wildlife Service, Office of Biological Services, 1977. Report FWS/OBS/77-24. p. 95-103.

Dispersants, Spill cleanup, Pollution control, Government agencies, Regulations

"The composition and use of chemical oil dispersants are discussed in relation to federal policy."

[from Chemical Abstracts 91(3):#14831n. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1192
RESEARCH NEEDED TO DETERMINE EFFECTIVENESS OF CHEMICALS IN TREATING OIL SPILLS AND THE TOXICITY OF CHEMICALLY DISPERSED OIL - WORKSHOP PROCEEDINGS
Exxon Production Research Company. 1978.
Houston, Texas, Exxon Production Research Company, 1978. 51 p.

Spill cleanup, Dispersants, Toxicity, Acute effects, Chronic effects, Marine organisms, Habitats

A panel of 14 internationally recognized scientists participated in a workshop dealing with the two title research concerns. Participants were divided into two groups; each group was asked to consider the problem of effects or toxicity of chemically treated oil spills versus untreated ones. This report presents and summarizes the research goals and priorities that were identified by the two groups.

79D-1193
MOVING BELT TYPE OIL SKIMMER WITH PROPULSION INDUCED FLOW
Grimes, E.L., and D.W. Lerch. 1979.
Australian Patent 498,043

Spill cleanup, Skimmers, Oil-water separation, Equipment, Design-engineering, Patent

Discussed is a method for recovering oil from a water surface while separating the water and recovered oil utilizing an endless oil-water separation filter belt technique.

[from Petroleum Abstracts 19(31):#266,002. 1979]

79D-1194
OIL SPILL CLEANUP ACTIVITIES
Hann, R.W., L. Rice, M.-C. Trujillo, and H.N. Young, Jr. 1978.
The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 229-275.

Spill cleanup, Physical aspects, Behavior, Amoco Cadiz spill, Pollution control, France

The authors discuss the physical properties, behavior and movement of oil from the Amoco Cadiz spill and its ultimate deposition on the beaches. The organizational structure established to clean up the spill and the strategy of control are presented and evaluated with regard to their utility in other spills.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1195
SEPARATION OF OIL ON WATER
Hoketsu, H. 1979.
Japanese Patent Application 79 33,887

Spill cleanup, Oil removal, Patent

"Polar plastic coated rice hulls are spread over oil films on water, and stirred to remove the oil."

[from Chemical Abstracts 91(4):#26872q. 1979]

79D-1196
REMOVAL OF OIL AND COLORING MATTER FROM CONTAMINATED WATERS USING SHALE AS ADSORBENT
Kamiya, S., F. Hase, and S. Takeshita. 1978.
Japanese Patent 78 18,194

Spill cleanup, Wastewater treatment, Adsorption, Patent, *Powdered shale

Colored matter and oil in water are adsorbed on powdered shale and a gel is formed. The gel is separated and dried and the oil and colored matter are separated from the shale.

[from Chemical Abstracts 89(24):#203974f. 1978]

79D-1197
CHEMICAL CONTROL OF OIL SPILLS AND HAZARDS
Kaufmann, S. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter. (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 89-97. ASTM Special Technical Publication 659.

Spill response, Dispersants, Economics, Pollution control

Economical and practical considerations for the use of dispersants in a variety of accidental spill situations on land or water are examined. Past practices are reviewed and future directions are discussed.

79D-1198
PERFORMANCE TESTING OF THREE OFFSHORE SKIMMING DEVICES
Lichte, H.W., and M.K. Breslin. 1978.
Report HCP/P3241-01, Contract EE-77-A-28-3241. 90 p.

Spill removal, Equipment, Performance testing, Design-engineering, Skimmers

Performance testing results are presented for three commercial oil spill cleanup devices. Operating techniques based on test results are described.

[from Energy Research Abstracts 3(17):#41520. 1978]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1199
A SMALL-SCALE LABORATORY DISPERSANT EFFECTIVENESS TEST
Mackay, D., J.S. Nadeau, and C. Ng. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds). Philadelphia, American Society for Testing and Materials, 1978. p. 35-49. ASTM Special Technical Publication 659.

Dispersants, Performance testing, Behavior, Simulations, Physical aspects

A small-scale laboratory system is described in which known quantities of oil and dispersant are introduced on a water surface at a controlled temperature, and turbulence and dispersion behavior are observed. The design and performance of the apparatus are described. Results are presented for experiments in which turbulence, oil-to-dispersant ratio, and temperature were varied. The advantages and disadvantages of the system are outlined, and the possibility of relating sea state to conditions in the system is discussed.

79D-1200
DEVELOPMENT OF AN OIL DISPERSANT SPRAYING SYSTEM
Manolio, V.P., Jr., and L.T. McCarthy, Jr. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Sciety for Testing and Materials, 1978. p. 81-88. ASTM Special Technical Publication 659.

Dispersants, Equipment, Design-engineering, US, USSR, Performance testing, EPA, *OHMSETT facility

A joint effort between the US, EPA and the USSR Central Scientific Research Institute was initiated to examine various oil dispersants and application methods, and to establish a uniform series of acceptance tests.

79D-1201
CHEMICAL DISPERSANTS FOR THE CONTROL OF OIL SPILLS
McCarthy, L.T., Jr., G.P. Lindblom, and H.F. Walter (eds.). 1978.
Philadelphia, American Society for Testing and Materials, 1978. 307 p.
ASTM Special Technical Publication 659.

Dispersants, Toxicity, Performance testing, Simulations, Equipment, Environmental effects, Guidelines, *ASTM symposium

This book presents a collection of 22 papers on the title topic, presented at a symposium sponsored by the ASTM Committee on Spill Control Systems in Williamsburg, Virginia, 4-5 October 1977. Among the topics coverd are dispersant toxicity testing, evaluation of techniques and equipment for their application, guidelines for their usage, and their environmental effects.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1202
PERFORMANCE TESTING OF THE TETRADYNE HIGH SPEED AIR JET SKIMMER
McCracken, W.E., and S.H. Schwartz. 1978.
Report EPA/600/2-78/187, Contract EPA-68-03-0490. 45 p.

Spill cleanup, Skimmers, Performance testing, Equipment, Design-engineering, EPA, *OHMSETT facility

The skimmer tested depends on an air jet impacting the water surface at an angle and deflecting rapidly moving, floating spilled material laterally into a low-current chamber. The four test fluids include No. 2 fuel oil, naphtha, and two lubricating stocks. The effects of several variables (film thickness, fluid viscosity, etc.) on skimmer performance are presented.

[from Government Reports Announcements 79(5):166. #PB-287 822. 1979]

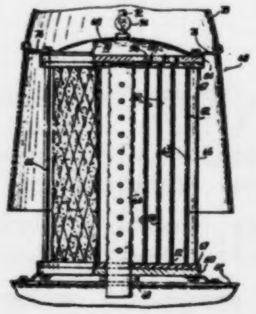
79D-1203
OIL RECOVERY PROCESS
National Marine Service , Inc. 1977.
US Patent 4,053,414

Oil removal, Skimmers, Booms, Filtration, Gravity separation, Equipment, Design-engineering, Patent

A vessel is provided with a gravity separation tank, a boom and skimmer. A manifold on the inner periphery of the tank discharges skimmed oil and water into the tank. Means of filtering drawn off water are provided and filtered water is discharged. Pumps can reverse the flow of water to backwash coalescing filters.

[from Energy Research Abstracts 3(3):625. #5972. 1978]

4,053,414
OIL RECOVERY APPARATUS
Cornelis in't Veld, Vlaardingen, Netherlands, assignor to National Marine Service, Inc., St. Louis, Mo.
Filed Aug. 3, 1976, Ser. No. 711,215
Claims priority, application Netherlands, Nov. 26, 1975, 7513810
Int. Cl.^{2} B01D *21/24*
U.S. Cl. 210—117 **9 Claims**



B. OIL POLLUTION PREVENTION AND CONTROL

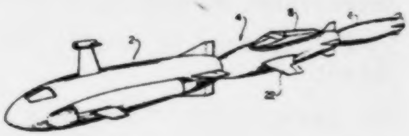
79D-1204
SKIMMER FOR OIL SPILLS
Nagy, C.E., and J.F. Nagy. 1979.
US Patent 4,145,290

Spill cleanup, Skimmers, Equipment, Design-engineering, Patent

The skimmer has a submersible hull within which is located a surge tank for receiving oil and water skimmer from the surface. A funnel at the top of the skimmer projects through the hull into the surge tank. Means are provided for controlling the flow through the funnel and pumping oil out of the surge tank. A coupler on the nose of the hull enables coupling of the skimmer to a towing vehicle.

[from Petroleum Abstracts 19(28):#265,131. 1979]

4,145,290
SKIMMER FOR OIL SPILLS
Charles E. Nagy, 3221 Bend Pl., Hollywood, Calif. 90068, and
John F. Nagy, 785 W. End Ave., New York, N.Y. 10025
Filed Jul. 28, 1977, Ser. No. 819,704
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 S **16 Claims**



79D-1205
AERIAL APPLICATION OF DISPERSANTS IN BANTRY BAY FOLLOWING THE BETELGEUSE INCIDENT
Nichols, J.A., and I.C. White. 1979.
Marine Pollution Bulletin 10(7):193-197.

Spill cleanup, Dispersants, Ireland, *Betelgeuse spill, *Aerial application

"For the first time during a significant oil spill, aircraft were used in preference to surface vessels to apply chemical dispersants, following the tragic accident to the French registered tanker in Bantry Bay, south-west Eire. In this particular case, with an ideally situated landing strip, close to the source of the spill of fresh crude oil, the response proved to be highly effective and prevented the vast majority of the oil lost after the 6th day from reaching the nearby shorelines. The ability of the pilot of the spray aircraft to rapidly locate and to select for treatment only those slicks or parts of slick posing a significant threat also resulted in the minimum amount of dispersant being used to maximum effect."

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1206
OIL ABSORBENT ON WATER
Nishihara, H. 1979.
Japanese Patent Application 79 02,287

Oil removal, Absorption, Sorbents, Patent

The oil absorbent comprises cut or powdered polypropylene filament of average diameter 15-100 μ and ≥ 10 volumes foamed polyethylene powdered to 5-20 mm mixed in 30-60:70-40 ratio.

[from Chemical Abstracts 91(2):#9333x. 1979]

79D-1207
INSTALLATION TO COLLECT OIL OR SIMILAR MATERIAL FROM A WATER SURFACE
Nylands Verksted A/S. 1978.
Netherlands Patent Application 7,802,657

Spill cleanup, Skimmers, Booms, Ships, Equipment, Design-engineering, Patent

The device consists mainly of a bag of impermeable material stretched horizontally which can be towed by a ship. A boom is positioned between the ship and the bag. The bag has an inlet facing the towed device and an outlet for dumping the collected oil.

[from Petroleum Abstracts 19(31):#265,998. 1979]

79D-1208
VESSEL AND PROCEDURE TO REMOVE AND COLLECT OIL FLOATING ON WATER
Oil Mop, Inc. 1978.
Netherlands Patent Application 7,806,198

Spill cleanup, Spill removal, Ships, Equipment, Design-engineering, Patent

The vessel has a longitudinal hull with interconnected side sections and means to propel the hull through the water. Oil-catching material is between the sections.

[from Petroleum Abstracts 19(31):#266,003. 1979]

B. OIL POLLUTION AND CONTROL

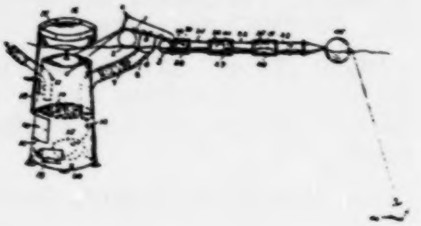
79D-1209
SYSTEM FOR COLLECTING OIL
Shyu, J.Y. 1979
US Patent 4,146,482

Spill cleanup, Oil-water separation, Skimmers, Sea surface, Equipment, Design-engineering, Patent

An apparatus for collecting oil floating on a sea surface is described. Waves cause oil and water to flow into a collecting panel and from there to a container, in which the oil and water can be separated and filtered and the oil pumped to a nearby ship.

[from Petroleum Abstracts 19(28):#265,132. 1979]

4,146,482
SYSTEM FOR COLLECTING OIL
Ji Yn Shyu, Kaohsiung, Taiwan, assignor to Yin-Lang Yang, Kangshan, Taiwan
Filed Feb. 22, 1978, Ser. No. 880,073
Int. Cl.² E02B *15/04*
U.S. Cl. 210—242 S **3 Claims**



79D-1210
OIL SPILL REMOVAL EQUIPMENT TECHNIQUES AND EQUIPMENT. VOLUME 2, 1976-JULY 1978. (A BIBLIOGRAPHY WITH ABSTRACTS)
Smith, M.F. 1978.
Report NTIS/PS-78/0960 84 p. Report for 1976-July 1978. (Supersedes NTIS/PS-77/0750, NTIS/PS-76/0637, NTIS/PS-75/542, and COM-74-10951.)

Spill removal, Oil-water separation, Skimmers, Dispersants, Sorbents, Absorption, Flotation, Equipment, Spreading, Bibliographies

The removal processes are discussed for oil-water separators, skimmers, dispersants, absorbents, flotation and combustion. Studies are presented concerning oil spreading, droplet entrainment, prototype removal systems, and equipment and costs.

[from Government Reports Announcements 78(23)::186. #NTIS/PS-78/0960. 1978]

79D-1211
TECHNIQUES FOR MIXING DISPERSANTS WITH SPILLED OIL
Smith, G.F. 1978.
Report EPA/600/2-78/128, Contract EPA-68-03-0490. 50 p. Final report.

Spill cleanup, Equipment, Design-engineering, Dispersants, *Dispersant application

Test results are given of an EPA-sponsored project to measure the relative effectiveness of four devices for adding mixing energy to an oil slick after dispersant application. A modified five-bar gate proved to be the most effective for breaking up a 1 mm thick oil slick into droplets with the greatest overall penetration (2.4 m) at a tow speed of 2.0 m/s.

[from Government Reports Announcements 78(26):149. #PB-285 679. 1978]

79D-1212
OHMSETT 'HIGH SEAS' PERFORMANCE TESTING: MARCO CLASS V OIL SKIMMER
Smith, G.F., and W.E. McCracken. 1978.
Report EPA/600/2-78/093, Contract EPA-68-03-0490. 49 p. Final report.

Skimmers, Equipment, Design-engineering, Spill cleanup, Performance testing, *OHMSETT facility

A MARCO Class V skimmer was tested in high seas conditions. Skimmer efficiency is described at various belt speeds and induction pump rates in oder to define optimum settings and to better define oil-water separator needs.

[from Government Reports Announcements 78(22):201. #PB-283 390. 1978]

79D-1213
REMOVAL OF A WATER-INSOLUBLE ORGANIC COMPOUND FROM A SURFACE
Sonnergaard, R.E. and L.A.S. Waag. 1979.
German patent application 2,846,926

Spill removal, Emulsification, Patent

"Fuel oil is recovered from seawater by emulsifying the oil with a phosphate ester of an alkoxylated alcohol, breaking the emulsion by adding a base, and separating the oil phase."

[from Chemical Abstracts 91(8):#59245r. 1979]

79D-1214
DEVICE FOR RETRIEVING FLOATING POLLUTANTS ON SURFACE WATER
Stupica, V.A. 1979.
US Patent 4,133,765

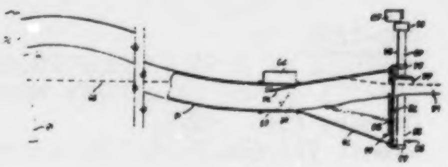
Spill cleanup, Skimmers, Equipment, Design-engineering, Patent

The apparatus employs a floating flexible barrier and has a reservoir tank coupled with the barrier so that oil is conveyed from the barrier to the tank by gravity flow.

[from Petroleum Abstracts 19(32):#266,224. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

4,133,765
DEVICE FOR RETRIEVING FLOATING POLLUTANTS ON SURFACE WATER
Vekoslav A. Stupica, 2911 N. 73rd Pl., Kansas City, Kans. 66109
Filed Sep. 21, 1977, Ser. No. 835,041
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 S 1 Claim



79D-1215
PERFORMANCE TESTS OF FOUR SELECTED OIL SPILL SKIMMERS
Urban, R.W., D.J. Graham, and S.H. Schwartz. 1978.
Report EPA/600/2-78/204, Contract EPA 68-03-0490. 84 p.

Spill cleanup, Skimmers, Equipment, Design-engineering, Performance testing, *OHMSETT facility

A series of tests are described which determined the range of best performance for each skimmer under the manufacturer's design limits. The four skimmers tested at the OHMSETT facility included the Oil Mop, the Cyclonet 050, the Clowsor skimmer, and the Bennett Mark 6E. A total of 198 individual test runs were made in an 8-week test period.

[from Government Reports Announcements 79(6):166. #PB-288 549. 1979]

79D-1216
APPLICATION OF THE PRINCIPLE OF THE INTEGRATION OF COMPATIBLE FUNCTIONS TO THE SYSTEM OF HYDROCARBON SPILL RECOVERY (THE SYSTEM, LOGISTICS AND STRUCTURE) [in French]
Vidilles, J. 1978.
Journal des Ingenieurs 27(1):21-26.

Spill cleanup, Design-engineering, Equipment, *SIRENE

A device called "SIRENE" designed for the cleanup of ocean oil spills is described.

[from Chemical Abstracts 89(22):#185627p. 1978]

79D-1217
OIL BINDING AGENT BASED ON NATURAL AND/OR SYNTHETIC RUBBER
Zwittnig, L. 1979.
Austrian Patent 348,491

Sorbents, Oil removal, Adsorption, Patent

Oil adsorbents are based on natural and/or synthetic rubber particles and contain 0.5-8 wt.% sawdust to avoid caking.

[from Chemical Abstracts 91(4):#22190t. 1979]

3. Environmental Restoration

79D-1218
RESPONSE OF A SALT MARSH TO OIL SPILL AND CLEANUP: BIOTIC AND EROSIONAL EFFECTS IN THE HACKENSACK MEADOWLANDS, NEW JERSEY
Dibner, P.C. 1978.
Report EPA/600/7-78/109, Contract EPA-68-03-2160. 62 p. Final report.

Spill cleanup, Marshes, Restoration, Recovery, Soil, Plants, Invertebrates, Crude oil

The study assesses the response of the title marsh to a number 6 crude oil spill in May 1976. Cleanup included cutting and removal of oiled grasses of the species Spartina alterniflora. Productivity, soil composition, invertebrate communities, and erosional trends were monitored. Conclusions suggest that cutting of heavily oiled grasses saved the plants from dying of root suffocation.

[from Government Reports Announcements 78(25):188. #PB-285 211. 1978]

4. Personnel Training

[No entries.]

5. Contingency Planning

79D-1219
PROCEEDINGS OF THE NATIONAL RESPONSE TEAM OIL SPILL SCIENTIFIC RESPONSE WORKSHOP, NEW ENGLAND
Conner, W.G., and P.U. Alkon. 1978.
Report EPA/600/7-78/196, Contract EPA-68-01-3188. 480 p.

Spill response, Spill cleanup, Contingency planning, *Proceedings

The principal objective of the workshop proceedings detailed in the title report "was to identify the scientific needs and capabilities, to be incorporated into a regional response plan for assessing the ecological damage due to major oil spills."

[from Government Reports Announcements 79(8):97. #PB-289732. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1220
SOME GUIDELINES FOR OIL-SPILL CONTROL IN COASTAL ENVIRONMENTS, BASED ON FIELD STUDIES OF FOUR OIL SPILLS
Gundlach, E.R., M.O. Hayes, C.H. Ruby, L.G. Ward, et al. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 89-97. ASTM Special Technical Publication 659.

Guidelines, Dispersants, Contingency planning, Spill cleanup, Beach cleanup, Intertidal zone, Shorelines

An understanding of factors influencing the distribution, damage, and long-term persistence of oil spills is essential for adequate planning and appropriate application of cleanup techniques. Based on a study of two massive tanker spills the Metula and the Urquiola, and two smaller spills, the Bouchard 65 and the Ethel H., these factors are wind stress and water currents, beach activity and grain size, tidal stage, wave energy, oil quantity and composition, and ice effects. These factors and initial biological effects were used as the basis for a classification of coastal environments in terms of potential oil spill damage.

79D-1221
ORGANIZATIONAL STRUCTURE, CLEANUP PROCESSES AND LEVEL OF RESOURCES UTILIZED IN THE CLEANUP OF THE AMOCO CADIZ OIL SPILL
Hann, R.W. 1979.
American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, DC, AAAS, 1979. p. 144. Abstracts.

Contingency planning, Spill cleanup, Amoco Cadiz spill, Pollution control, Coasts, France

This paper documents "the level of effort expended in dealing with the spill...so that those responsible for dealing with such a spill in the future will have good information as to the level of resources they should expect to expend to deal with such a spill, and the technologies which were chosen to be utilized under this particular set of oceanographic and meteorological conditions coupled with the high marine resource and recreational value of this important coast of France."

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1222
ECOLOGICAL DAMAGE ASSESSMENT OF OIL SPILLS - THE GOVERNMENT'S RESPONSE
Lefcourt, P. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 179-181.

Contingency planning, Government agencies, Legislation, Spill response

The legal justification and authorities for the federal government's response and participation in activities relative to spills of oil and hazardous substances are briefly discussed.

79D-1223
THE ROLE OF PHYSICAL STUDIES BEFORE, DURING AND AFTER OIL SPILLS
Milgram, J.H. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 5-14.

Oil spills, Physical aspects, Spill response, Spill cleanup, Argo Merchant spill

Physical studies, among others, are required to provide the on-scene cleanup coordinator with the scientific information necessary to guide the correct choice of optimum cleanup technology and logistics. The title article discusses the means by which this objective is met by physical studies and their role in the provision of accurate information relative to naturally occurring processes such as spreading, mass transport, dispersion, evaporation, and dissolution.

79D-1224
WHEN AN OIL SPILL HITS, BEING PREPARED IS YOUR BEST DEFENSE
Noel, H.S. 1979.
National Fisherman 60(6):45.

Contingency planning, Pollution control, *Mariculture projects

For coastal or estuarine mariculture projects, careful and continually updated contingency planning appears to be the best defense against oil spills. This article summarizes advice presented by Dr. Ian White, a fisheries biologist representing the International Tanker Owners' Pollution Federation Ltd., which administers compensation for those affected by tanker spills around the world.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1225
LOGISTIC REQUIREMENTS FOR AERIAL APPLICATION OF OIL SPILL DISPERSANTS
Ross, C.W., P.B. Hildebrand, and A.A. Allen. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 66-80. ASTM Special Technical Publication 659.

Dispersants, Simulations, Equipment, Cost analysis, *Aerial application

In the title study, selected factors involved in establishing the feasibility of aerial application of dispersants on oil spills were investigated. The approach focused on only those areas affecting operational feasibility and was based on general assumptions and mathematical formulas which could be used to evaluate other spill configurations, volumes, and locations, or other dispersant platforms.

79D-1226
SYSTEMS FOR ARCTIC SPILL RESPONSE, VOLS. 1 & 2
Schultz, L.A., P.C. Deslauriers, F.W. DeBord, and R.P. Voelker. 1978.
Report 405C-3 Vol-1,2; USCG-D-44-78-Vol 1,2, Contract DOT-CG-71343-A. 327 p., 138 p. Final report.

Spill response, Contingency planning, Spill cleanup, Cold climates, Ice, USCG

An optimum arctic pollution recovery system was determined by establishing the cost and effectiveness of responses for 16 oil spill response situations, and based on these, developing six alternative Coast Guard arctic response systems. The six systems were developed for three ice conditions: Thick stable ice, dynamic hummocky ice and open water/light ice. The scenarios are detailed together with response systems.

[from Government Reports Announcements 78(25):173. #AD-A053 732,733. 1978]

79D-1227
ANTI-OIL POLLUTION STRATEGY IN SULLOM VOE
Syratt, W.J., and M.G. Richardson. 1979.
The Marine Environment at Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Terminal Advisory Group, 1979. p. 23. Abstract.

Oil terminals, Pollution prevention, Contingency planning, Spill cleanup, Scotland, *Sullom Voe

The focus of this paper is upon environmental considerations of an oil spill contingency plan drawn up by the Sullom Voe Oil Spill Advisory Committee. An analysis of the sea areas and coastline is discussed which defines the accessibility of certain zones and identifies a number of sensitive areas for which specific recommendations for cleanup techniques are included.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1228
THE ARGO MERCHANT OIL SPILL ON-SCENE COORDINATORS REPORT
US Coast Guard. 1977.
Report AD-A062 028. 129 p.

Spill response, Spill removal, Contingency planning, Argo Merchant spill, USCG

The title report documents the oil spill response action initiated by the Coast Guard following the grounding and foundering of the tanker Argo Merchant on 12/13/76. Discussed are the cause of the accident, organization of response, actions committed, effectiveness of response and removal actions, unique problems encountered, and recommendations of means to prevent a reoccurrence.

[from Government Reports Announcements 79(7):148. #AD-A062 028. 1979]

79D-1229
ASSESSMENT PROBLEMS OF WHETHER OR NOT TO TREAT OIL SPILLS
Wilson, M.P., Jr. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McMarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 119-126. ASTM Special Technical Publication 659.

Dispersants, Environmental effects, Spill response

The decision to use dispersants on an oil spill requires a multiplicity of biological, chemical, physical and meteorological inputs. Much of the information required to conduct such an assessment is presently unavailable and must be obtained through laboratory, meso-scale, and in situ types of experiments. This paper discusses the kinds of information obtainable from each type of experiment and how these influence the assessment process.

79D-1230
SHORELINE OIL SPILL PROTECTION & CLEANUP STRATEGIES: SOUTHERN BEAUFORT SEA
Worbets, B.W. 1979.
Arctic Petroleum Operators' Association, Report of Project #136. Manual: 85 p.; Appendix:64 p.

Spill response, Contingency planning, Pollution prevention, Spill cleanup, Shorelines, Beaufort Sea, Arctic

The title manual is designed for on-scene commander's use during an oil spill, and recommends oil spill protection and cleanup strategies for identified sensitive coastal regions. The appendix discusses the process and logic that were followed to develop this work. The publications are available from the APOA Information Service, PO Box 1281, Station M, Calgary Alberta, Canada T2P 2L2.

6. Legal and Regulatory Aspects

79D-1231
OCEAN LAW (A BIBLIOGRAPHY WITH ABSTRACTS). VOLUME 2
Brown, R.J. 1978.
Report NTIS/PS-78/1083. 122 p. Report for 1977-October 1978. (Supersedes NTIS/PS-77/0948, NTIS/PS-76/0834, NTIS/PS-75/712, and NTIS/PS-74/134.)

Legislation, Marine environment, International agreements, Pollution control, Bibliographies

Cited are national and international laws on fishing, undersea mining, shipping, dredging, territorial waters, navigation regulations, offshore minerals, government policies, and water pollution. (This updated bibliography contains 55 new entries to the previous edition.)

[from Government Reports Announcements 78(25):33. #NTIS/PS-78-1083. 1978]

79D-1232
HAZARDOUS WASTE CLEAN-UP "SUPERFUND" BILL IN CONGRESS
Gaines, S.E. 1979.
Environmental Science & Technology 13(8):917.

Legislation, US, Liability, Compensation, Spill cleanup, *Superfund

The provisions of the proposed "superfund" legislation are discussed.

79D-1233
LAWS PASSED DURING THE 1977 SESSION OF THE MISSISSIPPI LEGISLATURE AFFECTING COASTAL RESOURCE MANAGEMENT, USE AND PROTECTION
University of Mississippi Law Center. 1977.
Report MASGP-78-012, NOAA-78062701, Grant NOAA-04-7-158-44017. 16 p.

Pollution prevention, Legislation, Resource management, Mississippi

Presented in the title study are those laws passed during the 1977 session of the Mississippi Legislature that would affect the use, development and protection of the state's marine resources. Specific subjects include mineral and non-living resources, industrial resources, and environmental control. [possibly oil pollution related]

[from Government Reports Announcements 78(22):29. #PB-284 739. 1978]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1234
U.S. BILL WOULD MAKE SPILLERS PAY, HELP VICTIMS COLLECT
Studds, G.E. 1979.
National Fisherman 60(2):56.

Liability, Compensation, Legislation, Regulations, US, Fisheries

A US congressman discusses the advantages and necessity of having comprehensive oil pollution liability and compensation legislation to aid the fishing industry in case of oil spillage.

79D-1235
OIL POLLUTION CONTROL MECHANISMS - STATUTES AND REGULATIONS
University of Mississippi Law Center. 1977.
NOAA, Report MASGP-78-014, Grant #04-7-158-44017. 71 p.

Pollution control, Legislation, Regulations, Spill response, Government agencies, Law enforcement

This analysis provides a detailed picture of federal statutes, regulations, and case law related to oil spill prevention and control. Emphasis is placed on federal action taken after a spill. The document touches briefly on acts having a lesser effect on oil pollution control, including the Refuse Act, the Ports and Waterways Safety Act, the OCS Lands Act, and the Oil Pollution Act.

7. General Prevention and Control Measures

79D-1236
PRACTICAL EXPERIENCE OF DISPERSANT USAGE
Garnett, M.J., and I.C. White. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 217-225. ASTM Special Technical Publication 659.

Dispersants, Spill cleanup, Pollution control, Coastal waters, Contingency planning

This papers reviews selected aspects of dispersant usage based on experience gained from oil spill incidents around the world. "Dispersants, applied correctly and after detailed consideration of the particular circumstances of the incident, have a role to play in combatting oil spillage at sea and can prevent or reduce damage to coastal resources and amenities. They should be regarded, however, only as one of the many courses of action open to cleanup controllers and not as a panacae for all ills."

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1237
DISPERSANT FIELD TRIALS IN CANADIAN WATERS - USE OF HOVERCRAFT AS A DISPERSANT SPRAYING PLATFORM
Gill, S.D. 1978.
Chemical Dispersant for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 159-168. ASTM Special Technical Publication 659.

Spill removal, Performance testing, Equipment, Dispersants, Canada, *Hovercraft spraying

"During the summer of 1977, modifications were made to the Canadian Coast Guard Voyageur hovercraft for preliminary studies to determine whether this vehicle, and possibly hovercraft in general, could be considered as potential platforms for oil spill dispersant spraying. Work to date indicates that air turbulence resulting from underskirt escapage, propellor wash, and forward velocity does not represent an obstacle that would deter the use of these vehicles as dispersant spraying platforms."

79D-1238
MOPPING UP AFTER THE AMOCO CADIZ
Houck, R. 1978.
Conservation News 43(9):1-2.

Spill cleanup, Environmental effects, Amoco Cadiz spill, Coasts, Mortality, Birds, Marine organisms, Fisheries, France

Briefly reviewed are the cleanup efforts and environmental effects of the Amoco Cadiz tanker spill, which contaminated well over 120 km of the coastline of France in March 1978. The spill resulted in heavy mortality to birds, fish and other marine organisms, and shellfish fisheries were particularly hard hit.

79D-1239
OIL SPILL CONTROL CHEMICALS - A CURRENT VIEW
Lindblom, G.P. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 127-140. ASTM Special Technical Publication 659.

Pollution control, Dispersants, Toxicity, Product information, *Application methods, *Spill control chemicals

This paper examines the current status of oil spill control chemicals, which herein are defined to include dispersants, collecting agents, shoreline protection agents, and post-spill cleaners. Discussed are the modes of action of the various chemicals, potential ecotoxicity, and application methods required to obtain best results. Boat and aerial application methods are described in detail with reference to their advantages and limitations.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1240
EVALUATION OF EQUIPMENT FOR AERIAL SPRAYING OF OIL DISPERSANT CHEMICALS
Lindblom, G.P., and C.D. Barker. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 169-179. ASTM Special Technical Publication 659.

Performance testing, Spill removal, Equipment, Dispersants, *Aerial spraying

The feasibility of using helicopters or large aircraft for dispersant spraying was evaluated. Results of these field tests indicate that aerial spraying is feasible and potentially useful in spill response, that careful attention should be given to operating parameters and spray equipment design, and that further tests at sea should be conducted.

79D-1241
CLEANUP EFFICIENCY AND BIOLOGICAL EFFECTS OF A FUEL OIL SPILL IN COLD WEATHER: THE 1977 BOUCHARD NO. 65 OIL SPILL IN BUZZARDS BAY, MASSACHUSETTS
Schrier, E. 1978.
Report URS-7004-05-01, EPA/600/7-78/133.

Spill cleanup, Spill response, Biological effects, Fuel oil, Contingency planning, Bouchard 65 spill, Buzzards Bay, Sampling, EPA

The objectives of the title study are to evaluate cleanup techniques used, make recommendations of alternative methods for future use, evaluate EPA sampling techniques, and assess environmental damage caused by the spill.

[from Government Reports Announcements 79(1):144. #PB-286 362. 1979]

79D-1242
STILL THINKING ABOUT OIL [editorial]
Sebek, V. 1979.
Marine Pollution Bulletin 10(5):121-122.

Government agencies, Pollution control, Legislation, Liability, Compensation, UK

The author discusses several steps taken by the British Parliament in response to the recent increase in oil pollution incidents. These include the establishment of a Marine Pollution Control Unit, the publication of a report on Measures to Prevent Collisions and Strandings of Noxious Cargo Carriers in Waters around the United Kingdom, and recommendations concerning fines for pollution offenses. A report published by an interdepartmental group appointed by the government is criticized on a number of points. The report addressed the following problems with reference to oil pollution: 1) Command, control and communications; 2) resources, research and development; 3) salvage; and 4) liability and compensation. The hope is expressed that the new Marine Pollution Control Unit will provide more effective monitoring of spills and enforcement of pollution control legislation than did the Department of Trade.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

1. Biological Aspects

79D-1243
AMOCO CADIZ DAMAGE EXTENSIVE [news brief]
Anon. 1978.
Conservation News 43(19):14.

Amoco Cadiz spill, Biological effects, Mortality, Birds, Marine organisms, Fisheries

Preliminary NOAA-sponsored research results indicate that there has never been "biological damage of this geographic extent in any previous oil spill." Of the 200,000 tons of oil spilled, significant amounts mixed into the water column as well as sinking to the ocean floor. Heavy mortality among birds and marine organisms, including commercial shellfish resources, was reported.

79D-1244
OIL AND THE SEA
American Petroleum Institute. 1979.
Washington, D.C., American Petroleum Institute, 1979. 22 p.

Biological effects, Fate, Oil spills, Chronic effects, Health hazards, Marine environment

Described in brief are overall conclusions of a series of studies conducted by the American Petroleum Institute regarding the effects of oil in the marine environment. Major research categories include oil and marine life, effects of oil spills, effects of chronic exposure, the fate of oil, and health aspects of oil spills.

79D-1245
RECRUITMENT OF BENTHIC ANIMALS AS A FUNCTION OF PETROLEUM HYDROCARBON CONCENTRATIONS IN THE SEDIMENT
Anderson, J.W., R.G. Riley, and R.M. Bean. 1977.
Report BNWL-SA-6559, CONF-7710169-1. 47 p.

Intertidal zone, Hydrocarbons, Benthos, Sediments, Depuration, Biological effects, Marine organisms, *Recruitment

Hydrocarbon depuration rates and recruitment of benthic organisms were measured in three intertidal zone installations, Sequim Bay, Washington, containing oiled and clean sediments. Hydrocarbon levels in sediments receiving surface applications of oil decreased more rapidly than in sediments mixed with oil. Recruitment of benthic organisms was not significantly inhibited in any of the installations.

[from Chemical Abstracts 91(3):#14742j. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1246
STUDY OF THE GEOGRAPHIC EXTENT AND ORIGIN OF FISH NECROSIS IN THE MEDITERRANEAN COAST [in French]
Aubert, M. 1979.
Revue Internationale d'Oceanographie Medicale 53-54:3-21.

Fish, Contamination, Health hazards, Biological effects, *Necrosis

Necrosis of fish studied along the Mediterranean coast appeared to be due to bacterial contamination and water pollution by various chemicals. [possibly oil pollution related]

[from Chemical Abstracts 91(3):#14842s. 1979]

79D-1247
SENSITIVITY OF THREE MICROALGAE TO CRUDE OILS AND FUEL OILS
Batterton, J.C., K. Winters, and C. Van Baalen. 1978.
Marine Environmental Research (1):31-41.

Crude oil, Fuel oil, Aromatic hydrocarbons, WSF, Toxicity, Algae, Microorganisms

Four crude and five fuel oils were tested for their toxicity to three microalgae and the results are presented. The data suggest that the toxicity of whole fuel oils is due to the less water-soluble compounds in the higher boiling aromatic fraction.

[from Chemical Abstracts 89(23):#191880g. 1978]

79D-1248
SENSITIVITY OF THREE MICROALGAE TO CRUDE OILS AND FUEL OILS
Batterton, J.C., K. Winters, and C. Van Baalen. 1978.
Report CONTRIB-275, NSF/IDOE-78/138, Grants NSF OCE73-9740-A01, NSF-OCE76-83913. 12 p.

Crude oil, Fuel oil, Biological effects, Algae, Microorganisms, PAH, Toxicity

Four crude and five fuel oils have been tested for toxicity with a blue green algae, a green algae, and a diatom. Four of the fuel oils inhibited photosynthesis, while paraffinic and asphaltic fractions of fuel oil were non-toxic. Classes of PAH not accountable for toxicity observed include naphthalene, methylnaphthalenes, dibenzothiophenes, phenanthrenes, and compounds with volatilities greater than methylnaphthalenes.

[from Government Reports Announcements 79(6):84. #PB-289 049. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1249
SEABIRD POLLUTION RESEARCH HAS GONE ASTRAY [editorial]
Bourne, W.R.P. 1979.
Marine Pollution Bulletin 10(6):149-150.

Birds, Biological effects, *Research

The author argues that "research into the effects of pollution on seabirds has lost its way." The importance of sublethal biochemical effects of oil pollution, which is studied extensively in North America, is questioned relative to the direct effect of oil in killing birds. It is the author's feeling that chronic oil pollution is decreasing and that concern for its increase has distracted attention from the more insidious effects of toxic chemicals.

79D-1250
FISH PREDATION ON OIL CONTAMINATED PREY FROM THE REGION OF THE ARGO MERCHANT OIL SPILL
Bowman, R.E., and R.W. Langton. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 137-141.

Biological effects, Fish, Food web, Toxicity, Argo Merchant spill

The stomach contents of 21 species of fish and squid were analyzed to determine the potential impact of Argo Merchant oil on the fish stocks of the North Atlantic. Two potential pathways were established for the oil to have been passed on to the higher trophic levels.

79D-1251
HISTOPATHOLOGICAL ANALYSIS OF BENTHIC ORGANISMS FROM THE VICINITY OF THE ARGO MERCHANT WRECK
Brown, R.S., and K.R. Cooper. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 96-102.

Biological effects, Sublethal effects, Marine organisms, Benthos, Argo Merchant spill

A variety of benthic species were collected two months and seven months following the spill and examined histopathologically. The findings suggest that the effects of the spilled oil were, for the most part, within the physiological toleration limits of the macrobenthos, and that the overall impact of the spill was minor.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1252
BIOASSAYS WITH A NATURAL ASSEMBLAGE OF BENTHIC MACROINVERTEBRATES
Burks, S.L., and J.L. Wilhm. 1977.
American Society for Testing and Materials, Special Technical Publication 634. p. 127-136.

Refineries, Wastewaters, Toxicity, Bioassay, Invertebrates, Benthos

A bioassay method for determining the effects of environmental contaminants on populations of benthic macroinvertebrates is described. Continuous flow exposure tests for 30 and 32 days indicated that activated sludge-treated petroleum refinery wastewater caused a greater decrease in species diversity, number of taxa, and mean density of individuals than the sequential activated sludge-dual media-activated carbon treated effluent. The procedure permitted measurement of both pollution-sensitive and tolerant organisms.

79D-1253
BIOLOGICAL EFFECTS OBSERVED ALONG THE NORTHWEST COAST OF BRITTANY AS A RESULT OF THE *AMOCO CADIZ* OIL SPILL
Cross, F.A. 1979.
American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, D.C., AAAS, 1979. p. 44. Abstracts.

Amoco Cadiz spill, Biological effects, Shorelines, Mortality, Birds, Fisheries, France

Adverse biological effects of the spill were observed along about 150 km of coastline northwest of Brittany. Intertidal communities on coastlines facing in a westerly direction, the Aber-Benoit estuary, and Rulosquest Marsh were most severely impacted. More than 3200 dead birds were recovered; about 85% of these were shag cormorant, guillemot, razorbill, and puffin. The kelp-mariculture industry and the oyster fishery were among the most heavily impacted commercial fishing industries.

79D-1254
BIOLOGICAL OBSERVATIONS
Cross, F.A., W.P. Davis, D.E. Hoss, and D.A. Wolfe. 1978.
The *Amoco Cadiz* Oil Spill, A Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, D.C., Government Printing Office, 1978. p. 197-215.

Amoco Cadiz spill, Biological effects, Shorelines, Mortality, Birds, Fisheries, France

Some of the biological consequences of the *Amoco Cadiz* oil spill were assessed. Activities at selected sites included observations and photographs of biological effects along the coastline, visiting two bird hospitals and a marine sanctuary, and conducting interviews with representatives of various segments of the fishing industry.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1255
ACUTE AQUATIC TOXICITY AND DISPERSING EFFECTIVENESS OF OIL SPILL DISPERSANTS: RESULTS OF A CANADIAN OIL DISPERSANT TESTING PROGRAM (1973 TO 1977)
Doe, K.G., and P.G. Wells. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 50-65. ASTM Special Technical Publication 659.

Dispersants, Acute effects, Toxicity, Performance testing, Canada

An oil spill dispersant testing program was initiated in 1973 to evaluate the toxicity and dispersing effectiveness of dispersants submitted to Fisheries and Environment, Canada for approval prior to use in Canadian waters. Of the 19 dispersants initially screened, six passed both the toxicity and effectiveness criteria and were placed on the Canadian standard list of acceptable oil spill dispersants.

79D-1256
AMERICAN-SOVIET SYMPOSIUM ON THE BIOLOGICAL EFFECTS OF POLLUTION ON MARINE ORGANISMS (1ST)
Duke, T.W., and A.I. Simonov. 1978.
Report EPA/600/09-78/007. 176 p.

Biological effects, Analytical techniques, Environmental effects, Marine organisms, *Proceedings

Discussed in this symposium report are state-of-the-art for hydrobiological analysis of basic structural components of marine ecosystems and the influence of pollutants on these components. Results of laboratory research are presented. [possibly oil pollution related]

[from Government Reports Announcements 79(1):69. #PB-285 923. 1979]

79D-1257
REDUCTION OF BLOOD PLASMA COPPER CONCENTRATIONS IN A MARINE FISH FOLLOWING A SIX MONTH EXPOSURE TO CRUDE OIL
Fletcher, G.L., J.W. Kiceniuk, M.J. King, and J.F. Payne. 1979.
Bulletin of Environmental Contamination and Toxicology 22(4/5):548-551.

Fish, Crude oil, Toxicity, *Plasma, *Copper

Total protein, Cu^{++}, Zn^{++}, Ca^{++}, and Mg^{++} concentrations were measured in plasma of cunner (Tautogolabrus adspersus) following a six-month exposure to a surface slick of Venezuelan crude oil. Copper concentrations were significantly lower in oil-exposed females, and possibly in males, than in controls; the other plasma components measured were not significantly different between the oiled and control groups.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1258
CARCINOGENS FOUND IN THE PETROLEUM AND PETROCHEMICAL INDUSTRIES (CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE)
Harrison, E.A. 1978.
Report NTIS/PS-78/1345. 185 p.

Oil industry, Petrochemicals, Carcinogens, Health hazards, Toxicity, Regulations, Bibliographies

These worldwide citations pertain to petroleum and petrochemical-related carcinogens. Studies are included concerning health hazard evaluations, government regulations, and toxicity determinations of carcinogens. [possibly oil pollution related]

[from Government Reports Announcements 79(5):75. #NTIS/PS-78/1345. 1979]

79D-1259
SHELLFISH TECHNICAL ASSISTANCE
Hickey, J.M. 1978.
Report NOAA-8103101. 139 p. Final report.

Hydrocarbons, Biological effects, Mollusks, Resource management, Massachusetts

The last segment of the Massachusetts "Shellfish Technical Assistance" program is detailed. Major consideration in this segment (1/77-12/77) includes oil spill assessment, statewide hydrocarbon analysis, local management programs, and management of moderately contaminated areas.

[from Government Reports Announcements 7(4):94. #PB-288 933. 1979]

79D-1260
EMBRYOTOXIC AND TERATOGENIC EFFECTS OF CRUDE OIL ON MALLARD EMBRYOS ON DAY ONE OF DEVELOPMENT
Hoffman, D.J. 1979.
Bulletin of Environmental Contamination and Toxicology 22(4/5):632-637.

Birds, Crude oil, Toxicity, Development, Growth, Mortality, *Anas platyrhynchos, *Hatchability

At 24 hr of development, eggs of mallard ducks (Anas platyrhynchos) were treated externally with South Louisiana crude oil and monitored for 18 days. Sex, embryonic weights, crown-rump lengths, bill lengths, and external abnormalities were recorded in the survivors. Major declines in survival occurred between days 3 and 6 and between days 7 and 10. Survivorship and embryonic growth were lower and numbers of defects higher in oil-treated eggs than in controls. Aliphatic hydrocarbons used to treat an additional group of eggs had no effect on survival, growth, or abnormalities, indicating that the toxicity of the crude oil was not due to pore blockage and oxygen deprivation.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1261
MESA NEW YORK BIGHT ATLAS: MARINE AND COASTAL BIRDS
Howe, M.A., R.B. Clapp, and J.S. Weske. 1978.
Report NYSSGP-AM-78-003, NOAA-78102616. 92 p. NTIS Report PB-290334.

Birds, Coastal waters, New York, Environmental effects

A review is presented on the bird inhabitants of the New York Bight region, including a discussion of effects of oil pollution.

[from Chemical Abstracts 91(7):#50371w. 1979]

79D-1262
QUANTITATIVE MAMMALIAN CELL GENETIC TOXICOLOGY: STUDY OF THE CYTOTOXICITY AND MUTAGENICITY OF 70 INDIVIDUAL ENVIRONMENTAL AGENTS RELATED TO ENERGY TECHNOLOGIES AND 3 SUBFRACTIONS OF CRUDE SYNTHETIC OIL IN THE CHO/HGPRT SYSTEM
Hsie, A.W., J.P. O'Neill, and J.R. Sebastian. 1978.
Report CONF-780227-5, Contract W-7405-ENG-26. 37 p.

Toxicity, Mutagens, Crude oil, Chronic effects

Study results are presented which have determined the mutagenicity of a number of diversified agents including 27 polycyclic hydrocarbons. "The assay appears to be applicable to monitoring of the genetic toxicity of crude organic mixtures..."

[from Government Reports Announcements 78(19):41. #CONF-780227-5. 1978]

79D-1263
ONSHORE SURVEY OF MACROBENTHOS
Hyland, J.L. 1978.
The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978, p. 216-228. (Appendix, Chapter 5)

Amoco Cadiz spill, Biological effects, Benthos, Invertebrates, Onshore, Toxicity, France

A preliminary onshore survey following the Amoco Cadiz spill was conducted to evaluate the extent of the oiling of benthic macrofaunal species and the magnitude of onshore ecological impact.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1264
AN OIL VULNERABILITY INDEX FOR MARINE ORIENTED BIRDS
King, J.G., and G.H. Sanger. 1979.
Conservation of Marine Birds of Northern North America, International Symposium held at the Seattle Hyatt House, Seattle, Washington, 13-15 May 1975. Washington, DC, Department of the Interior, Fish and Wildlife Service, 1979. p. 227-239.

Biological effects, Birds, Mortality, *Vulnerability index

"The 176 species of birds using marine habitats of the Northeast Pacific are graded on the basis of 20 factors that affect their survival." The total score is the Oil Vulnerability Index (OVI). Using this system, one can rank the avifauna of different areas according to their vulnerability to environmental hazards and aid in making management decisions.

79D-1265
EFFECT OF PETROLEUM PRODUCTS AND DISPERSANTS ON THE SURVIVAL OF ZOOPLANKTON SPECIES IN THE WHITE SEA [in Russian]
Koroleva, A.M. 1979.
Biologicheskie Nauki 1:105.

Fuel oil, Dispersants, Zooplankton, Toxicity, Mortality

Numbers of White Sea zooplankton decreased significantly following exposure to diesel fuel, motor oil and two dispersants. The degree of effect depended on the type of zooplankton and the concentration and time of exposure to the toxicants.

[from Chemical Abstracts 91(3):#14720a. 1979]

79D-1266
EFFECT OF DISSOLVED PETROLEUM PRODUCTS ON LIVER CARBOHYDRATE METABOLISM IN TWO BLACK SEA FISH SPECIES [in Russian]
Kovaleva, G.I. 1979.
Biologiya Morya, Vol. 1:66-71.

Fish, Petroleum products, Biological effects, Metabolism, *Liver, *Glucose

"Addition of dissolved petroleum products to water caused hyperglycemia, decrease in liver glycogen, and a decrease in the rate of glucose release by liver slices in Spicara smaris and Solea lascaris nasuta. Incubation of liver slices from intact fish in dissolved petroleum products stimulated glucose excretion."

[from Chemical Abstracts 91(3):#14768x. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1267
EFFECTS OF THE WATER SOLUBLE FRACTION OF A VENEZUELAN HEAVY FUEL OIL (NO. 6) ON COD EGGS AND LARVAE
Kuhnhold, W.W. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 126-130.

Biological effects, Fuel oil, Fish, Mortality, Reproduction, *Argo Merchant* spill

One-half, three, and seven day old eggs, and two, four, and eight day old larvae were exposed to the WSF of Bunker C oil in static tests. Hatching success, survival times, and heartbeat rates were measured and compared with control groups. An attempt was made to extrapolate laboratory findings to field conditions which existed at the time of the *Argo Merchant* spill.

79D-1268
GENETIC TOXICITY TESTING FOR COMPLEX ENVIRONMENTAL EFFLUENTS
Larimer, E.W., and J.L. Epler. 1978.
Report CONF-780327-1, Contract W-7405-ENG-26. 10 p.

Biological effects, Crude oil, Bioassay, Mutagens, Toxicity

Various test systems were used to assay the mutagenic potential of crude synthetic oils and natural crude oils. Mutagenicity data on isolated or suspected organic components are given. "The results support the use of the short-term genetic tests in determining the advantages of coupling the bioassays with chemical fractionation."

[from Energy Research Abstracts 3(16):#38258. 1978]

79D-1269
PHOTOOXIDATION PRODUCTS OF A FUEL OIL AND THEIR ANTIMICROBIAL ACTIVITY
Larson, R.A., T.L. Bott, L.L. Hunt, and K. Rogenmuser. 1979.
Environmental Science & Technology 13(8):965-969.

Fuel oil, Oxidation, GC/MS, Microorganisms, Toxicity, *Photooxidation

"Molecular identification and antimicrobial activity are reported for some constituents of the acidic fraction of no. 2 fuel oil photoproducts."

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1270
A LITERATURE REVIEW - PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 8. ENVIRONMENTAL ASPECTS OF DIESEL FUEL AND FOG OILS SGF NUMBER 1 AND SGF NUMBER 2 AND SMOKE SCREENS GENERATED FROM THEM
Liss-Suter, D. 1978.
Report AD-A056 021, Contract DAMD17-77-C-7020. 131 p. Final report.

Biological effects, Toxicity, Marine organisms, Birds, Fish, Mollusks, Zooplankton, Bibliographies, *Diesel fuel

Topics investigated in the title study include the effects of petroleum fuels and lubricants on waterfowl, birds, insects, plants, nematodes, fish, marine worms, mollusks, crustaceans, and other marine organisms, phytoplankton, microorganisms, and zooplankton.

[from Government Reports Announcements 78(21):94. #AD-A056 021. 1978]

79D-1271
FIELD AND LABORATORY MEASUREMENTS OF STRESS RESPONSES AT THE CHROMOSOME AND CELL LEVELS IN PLANKTONIC FISH EGGS AND THE OIL PROBLEM
Longwell, A.C. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 116-125.

Biological effects, Fish, Reproduction, Mortality, Growth, Argo Merchant spill, *Cytogenetics

Results are discussed of the post Argo Merchant spill examination of dissected embryos of 79 cod and 162 pollock eggs to detect abnormalities in chromosome makeup at the early embryo stage. It is believed that a reliable, recently developed methodology for conducting cytological and cytogenetic studies on fish eggs can be used as one of the most sensitive practical indicators of the sublethal effects of marine pollutants on reproduction in fish.

79D-1272
DISPOSITION AND METABOLISM OF AROMATIC HYDROCARBONS IN MARINE ORGANISMS
Malins, D.C., T.K. Collier, and H.R. Sanborn. 1979.
American Chemical Society Symposium Series 1979, 79 (Pesticide and Xenobiotic Metabolism in Aquatic Organisms):57-75.

PAH, Marine organisms, Metabolism, Behavior

"A review with 48 references." [possibly oil pollution related]

[from Chemical Abstracts 91(5):#33584a. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1273
A BIOLOGIST LOOKS AT OIL IN THE SEA
Mann, K.H. 1978.
Shore & Beach 46(4):27-29.

Ecosystems, Biological effects, Plants, Animals, Arctic

In assessing biological effects of oil spills, three basic biological principles must be taken into consideration: The built-in variability in the response of plant and animal populations to pollution; the productivity and vulnerability of the nearshore environment; and the reduction in number of species as a response to stress in a biotic community. The author discusses these three principles in light of Arctic ecosystems which would be far more severely impacted by oil pollution than ecosystems in temperate waters.

79D-1274
OCCURRENCE OF OILY FISH AND FOOD CHAIN OF PETROLEUM COMPOUNDS. II. TRANSFER OF N-PARAFFINS IN PETROLEUM AND OIL DISPERSER TO SHELLFISH [in Japanese]
Miyake, Y. 1978.
Okayama Igakkai Zasshi 90(5-6):613-622.

Crude oil, Hydrocarbons, Mollusks, Uptake, Depuration, Food web

During an 8-day exposure of the clam Venerupis amygdala japonica to a crude oil suspension, the C_{13}-C_{20} compounds of an n-paraffin series were taken up by the clam. Concentration factors of 40-176 for C_{12}-C_{24} n-paraffins were observed in the clams in 5 days. The C_{13}-C_{15} compounds were released sooner than the C_{16}-C_{20} compounds in seawater.

[from Chemical Abstracts 89(25):#209963y. 1978]

79D-1275
CHEMICAL CARCINOGENESIS: POLYCYCLIC AROMATIC HYDROCARBONS AND RELATED COMPOUNDS
National Cancer Institute. 1979.
Report NTISUB/E/356. __ p. Cancergram CK07.

PAH, Carcinogens, Health hazards, Biological effects, Chronic effects

The title cancergram deals with the carcinogenicity of PAHs and certain related nitrogen heterocyclic analogs having similar mechanisms of carcinogenesis. It covers activation and metabolism, macromolecular binding, cellular effects and lesions, mutagenicity and in vitro testing, and analytical methods for the compounds and their derivatives. This report excludes studies in which PAH's have been used simply as a tool to induce experimental tumors for other studies. [possibly oil pollution related]

[from Government Reports Announcements 79(5):85. #NTISUB/E/356. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1276

TOXICITY TESTING IN THE UNITED KINGDOM FOR THE EVALUATION OF OIL SLICK DISPERSANTS

Norton, M.G., F.L. Franklin, and R.A.A. Blackman. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 18-34. ASTM Special Technical Publication 659.

Dispersants, Toxicity, Bioassay, Beaches, Marine organisms

Following passage of the 1974 Dumping at Sea Act, dispersant evaluation methods in UK waters were reviewed and dispersants are now licensed for offshore or beach use, based on two tests to assess the environmental effect of dispersant use. Both the "sea" test and the "beach" test compare the effects of a dispersant with a control designed to simulate the situation where the dispersant is not used. The UK criteria for licensing products on the basis of these test results are discussed.

79D-1277

EFFECT OF SOME PETROLEUM PRODUCTS AND DISPERSANTS ON THE POPULATION AND PRODUCTIVITY OF BACTERIOPLANKTON IN THE WHITE SEA

Ogarkova, O.A., and V.N. Maksimov. 1978.
Biologicheskie Nauki 6:140.

Fuel oil, Dispersants, Toxicity, Bacteria, Microorganisms, *Bacterioplankton, *White Sea

Diesel fuel and motor oil had a favorable effect on bacterioplankton while the dispersant Diproxamine 57 had an inhibitory effect within two days of exposure of the microorganisms to 10 mg/L.

[from Chemical Abstracts 89(25):#209886a. 1978]

79D-1278

TRANSFER OF PETROLEUM POLYCYCLIC AROMATIC HYDROCARBONS TO SHELLFISH

Ogata, M., and Y. Yamasaki. 1978.
Igaku to Seibutsugaku 96(5):379-383.

Mollusks, PAH, Concentrations, Uptake, Chemical analysis, *Clams

"Short-necked clams were reared for 8 days in seawater containing 50 ppm petroleum in which 3,4-benzopyrene was dissolved, and then reared for another 8 days in clean seawater." Analysis of the edible part of the clam by liquid chromatography showed that PAH concentration was increased day by day, with an accumulation coefficient on the eighth day of 136. The subsequent PAH half-life was 5 days.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1279
FURTHER STUDIES ON THE EFFECT OF PETROLEUM HYDROCARBONS ON MIXED-FUNCTION OXIDASES IN MARINE ORGANISMS
Payne, J.F., and N. May. 1979.
American Chemical Society Symposium Series 1979, 99 (Pesticide Xenobiotic Metabolism Aquatic Organisms):339-347.

Biological effects, Chemical effects, Fish, Invertebrates, Hydrocarbons, *Mixed-function oxidase activity

In contrast to various invertebrate species exposed to high concentrations of petroleum, fish showed induction of mixed function oxidase. However, when fish were exposed to pure hydrocarbons, no induction of aromatic hydrocarbon hydroxylase was noted. Oil dispersants had little effect on enhancing the inducing effect of oil spills.

[from Chemical Abstracts 91(7):#50611z. 1979]

79D-1280
OBSERVATIONS ON *ARGO MERCHANT* OIL IN ZOOPLANKTON OF NANTUCKET SHOALS
Polak, R., A. Filion, S. Fortier, J. Lanier, and K. Cooper. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 109-115.

Biological effects, Zooplankton, Crustaceans, Analytical techniques, *Argo Merchant* spill, *Spectrofluorometry

Zooplankton samples taken on Nantucket shoals were subjected to ultraviolet spectrofluorometric analysis to establish relative levels of contamination. Analysis revealed the presence of an oil-like material in the gut of some crustacean zooplankton. Spectrofluorometric analysis was proven to be of use in the definition of the geographic extent of oil in the water column and the persistence of oil residues following an oil spill.

79D-1281
EFFECT OF THE *ARGO MERCHANT* OIL SPILL ON BIRD POPULATIONS OFF THE NEW ENGLAND COAST 15 DECEMBER 1976 - JANUARY 1977
Powers, K.D., and W.T. Rumage. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 142-148.

Biological effects, Birds, Mortality, Toxicity, *Argo Merchant* spill

The title article documents the result of bird mortality studies in December 1976. During the study 1120 birds of 13 species were sighted, 92 percent of which were gulls. Approximately 59 and 41 percent of the total number of herring and great black-backed gulls were oiled. Examination of fifteen specimens of five species of beached birds indicated that lungs and kidneys were the most seriously affected vital organs. Data indicate that the overall impact of the spill on coastal bird populations was minimal.

79D-1282

INTERACTIONS BETWEEN PETROLEUM AND BENTHIC FAUNA AT THE *ARGO MERCHANT* SPILL SITE

Pratt, S.D. 1978.

In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 131-136.

Biological effects, Marine organisms, Benthos, *Argo Merchant* spill

Visual inspection of samples and partial identification of benthos in 14 samples provide the basis for the conclusions in the title report. The channel bottom fauna had a high standing crop of both sessile and motile species. There was a slight increase in density and diversity of interstitial benthos at the bow of the wreck in July 1977 in an oil concentration of 0.2-0.6 ppm compared to a concentration of 4-122 ppm at the same site in February 1977.

79D-1283

AVIAN RADIOECOLOGY ON A NUCLEAR POWER STATION SITE. OCCURRENCE AND EFFECTS OF CHRONIC LOW-LEVEL OIL CONTAMINATION IN A POPULATION OF SOOTY TERNS (*STERNA FUSCATA*)

Robertson, M.J. 1978.

Report COO-2308-006. 48 p.

Birds, Contamination, Chronic effects, Sublethal effects, **Sterna fuscata*

The title population was monitored from 1962 to 1977 for the occurrence of oil on plumage and effects of chronic, low-level contamination. Occurrence of oiled plumage ranged from 0.2% to 12% with increasing incidence from the 1960's to the 1970's. Oiling had no effect on bird weight or nesting. Sooty terns were less susceptible to oil pollution than other sea birds because of their mode of food capture.

[from Chemical Abstracts 91(3):#14743k. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1284
AFTERMATH OF HUGE AMOCO CADIZ SPILL PROVES EFFECTS OF OIL ON MARINE LIFE
Russell, J. 1979.
National Fisherman 60(4):52-53.

Marine organisms, Fisheries, Environmental effects, Mortality, Amoco Cadiz spill, France

This article recounts the Amoco Cadiz tanker grounding off the coast of Brittany in March 1978 and discusses the impacts on shellfish and commercial fisheries. About 40,000 to 50,000 tons of the spilled oil are now resting on the nearshore sea floor, and the long-term effects of this remaining oil are as yet unclear.

79D-1285
MICROSCOPIC OBSERVATIONS ON VERTEBRATES AND INVERTEBRATES COLLECTED NEAR THE ARGO MERCHANT OIL SPILL
Sawyer, T.K. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 93-95.

Biological effects, Baseline studies, Fish, Mollusks, Crustaceans, Argo Merchant spill, *Histopathology

Fish, mollusks, crustaceans, sea urchins, and starfish were collected near the wreck site. Histopathological findings that could be directly attributed to the exposure to petroleum were not seen in any of the tissues examined. This report summarizes observations made on this diverse group of vertebrate and invertebrate species.

79D-1286
THE ARGO MERCHANT SPILL AND THE FISHERIES
Sherman, K., and D. Busch. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 149-165.

Biological effects, Fish, Mortality, Zooplankton, Toxicity, Argo Merchant spill

Results of the title study indicate that the impact of oil spilled from the Argo Merchant on fish stocks has not been catastrophic. No evidence of large-scale mortalities of juvenile or adult fish was observed in the 12 months following the spill. There was evidence of oil contamination in fish, shellfish, and zooplankton populations in the area of the spill. A more significant problem in the long run concerns the chronic background levels of petroleum hydrocarbons present in the surface waters inhabited by fish eggs and larvae.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1287
MIXED FUNCTION OXYGENASE ACTIVITY IN BLUE CRAB, *CALLINECTES SAPIDUS*: TISSUE DISTRIBUTION AND CORRELATION WITH CHANGES DURING MOLTING AND DEVELOPMENT
Singer, S.C., and R.L. Lee. 1977.
Report NSF/IDOE-77/212, Grant NSF-OCE 76-84108. 11 p.

PAH, Metabolism, Biological effects, Growth, **Callinectes sapidus*

A group of microsomal enzymes, referred to as mixed-function oxygenases, are responsible for the metabolic modification of many foreign compounds in animals. Arylhydrocarbon oxygenase is involved in the hydroxylation of the aromatic ring. The occurrence of this activity in tissues of the blue crab is discussed.

[from Government Reports Announcements 79(2):66. #PB-287 074. 1979]

79D-1288
EFFECTS OF KUWAIT OILS ON FEEDING RATES OF COPEPODS
Spooner, M.F., and C.J. Corkett. 1979.
Marine Pollution Bulletin 10(7):197-202.

Crude oil, WSF, Dispersants, Toxicity, Sublethal effects, Crustaceans, *Copepods

"Sublethal toxicity and recovery tests were made on feeding rates of 4 species of copepods using Kuwait oils kept in suspension on a slowly rotating wheel. Counts of faecal pellets from individuals fed on standard algal suspension were made after 20 h at 12° C. This exposure produced only marginal effects at 1 and 2 ppm, but 10 ppm produced definite effects on planktonic species. Recoveries were generally quite good from 'weathered' oil treatments. Oils emulsified alone did not produce significantly different effects in these experiments from oils emulsified with dispersants."

79D-1289
BUNKER C FUEL OIL REDUCES MALLARD EGG HATCHABILITY
Szaro, R.C. 1979.
Bulletin of Environmental Contamination and Toxicology 22(6):731-732.

Fuel oil, Toxicity, Birds, Mortality, **Anas platyrhynchos*, *Hatchability

Bunker C fuel oil was applied to the surface of mallard duck (*Anas platyrhynchos*) eggs in amounts of 5, 10, 20, and 50 µl on the eighth day of incubation. Hatching success and survival up to six days after treatment were significantly reduced in all oil-treated groups when compared to controls.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1290
SOME PHYSIOLOGICAL EFFECTS OF THE ARGO MERCHANT OIL SPILL ON SEVERAL TELEOSTS AND BIVALVE MOLLUSKS
Thurberg, F.P., E. Gould, and M.A. Dawson. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 103-108.

Biological effects, Mollusks, Fish, Sublethal effects, Argo Merchant spill

Blood samples were taken from a variety of teleost species and bivalves and subjected to physiological and biochemical tests. Disruption of serum ions appeared in winter flounder, yellowtail flounder and haddock. Gill tissue oxygen consumption appeared in first samples of ocean scallops and horse mussels, whereas malic dehydrogenase activity was significantly decreased in scallop muscles. Other findings are discussed and compared to samples taken outside of the impacted areas.

79D-1291
EVALUATION OF MARINE INVERTEBRATE SPECIES DIVERSITY AS AN OIL TOXICITY INDICATOR FROM LABORATORY STUDIES
Vanderhorst, J.R., and P. Wilkinson. 1978.
Canada, Fisheries and Marine Service, Technical Report 818:134-152.

Fuel oil, Bioindicators, Toxicity, Analytical techniques, Algae, Invertebrates, *Species diversity

Artificial substrates colonized by marine algae and invertebrates were exposed to seawater contaminated with No. 2 fuel oil for six months. Results indicated a depression in species diversity and species richness for oil-treated colonies and a depression in species diversity for artificially-lighted colonies as compared to controls. Major compositional shifts occurred in both treated and control colonies during the course of the experiment indicating shortcomings in the use of species diversity as a toxicity indicator.

[from Chemical Abstracts 91(1):#880r. 1979]

79D-1292
DAPHNIA FOR SUPERIOR SUBLETHAL TESTING
Westlake, G.F., D.W. Rowe, J.B. Sprague, T.A. Heming, and I.T. Brown. 1978.
Canada, Fisheries and Marine Service, Technical Report 818:20-30.

Refineries, Wastewaters, Sublethal effects, Toxicity, Monitoring, Bioindicators, *Daphnia

A study conducted to develop a sublethal toxicity test and document the toxicity of an oil refinery effluent meeting federal standards found Daphnia pulex to be the most sensitive and easily used organism on which to carry out the tests.

[from Chemical Abstracts 91(1):#878w. 1979]

79D-1293
CHEMICAL IMMOBILIZATION, BASELINE HEMATOLOGICAL PARAMETERS AND OIL CONTAMINATION IN THE SEA OTTER
Williams, T.D. 1978.
Report MMC-77/06, Contract MM7AD094. 33 p. Final report.

Animals, Biological effects, Toxicity, Contamination, Marine mammals, *Sea otter

The focus of this study was to compare techniques of chemical immobilization, investigate blood parameters, and explore the effects of oil contamination upon the sea otter, Enhydra luris. A contaminated otter was cleaned and released with a telemetry transmitter. Initial studies of three intra-muscular anesthetics indicated that Entorphine and C1744 have potential for safe field use with otters.

[from Government Reports Announcements 78(23):92. #PB-283 969. 1978]

2. Physical and Chemical Aspects

79D-1294
EXPERIMENT FOR TYPING FRESH GROUND WATER IN THE PEOPLE'S REPUBLIC OF BULGARIA ACCORDING TO THE DEGREE OF VULNERABILITY FOR POLLUTION [English summary]
Antonov, Kh., and B. Raikova. 1978.
Khidrologiya i Meteorologiya 27(6):12-20.

Groundwater, Soil, *Vulnerability, *Bulgaria

The relation between soil structure and degree of fresh groundwater pollution is discussed. [possibly oil pollution related]

[from Chemical Abstracts 91(4):#26965x. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1295
WEATHERING EFFECTS ON THE CHEMICAL COMPOSITION OF THE *AMOCO CADIZ* OIL
Calder, J.A. 1979.
American Association for the Advancement of Science National Meeting, 145th, Houston, TX, 3-8 Jan.1979. Washington, DC, AAAS, 1979. p. 43-44. Abstracts.

Amoco Cadiz spill, Weathering, Chemical effects, Emulsions, Aromatic hydrocarbons, France

The *Amoco Cadiz* cargo was transformed into a water-in-oil emulsion (mousse) almost immediately after release from the tanker or even prior to release; floating mousse adjacent to the ship contained 40-60% water, while beach mousse contained up to 75% water. Major effects of weathering included significant loss of n-alkanes through C_{14} and aromatic hydrocarbons through C_3 naphthalenes, increase in the proportion of polar material, and some reduction in alkane/isoprenoid ratios.

79D-1296
CHEMICAL COMPOSITION OF SELECTED ENVIRONMENTAL AND PETROLEUM SAMPLES FROM THE *AMOCO CADIZ* OIL SPILL
Calder, J.A., J. Lake, and J. Laseter. 1978.
The *Amoco Cadiz* Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 21-83.

Amoco Cadiz spill, Weathering, Chemical effects, Aromatic hydrocarbons, France

The title study investigated the nature and composition of the initial petroleum entering the environment and the transformation of the oil during the weathering process.

79D-1297
SOME OBSERVATIONS ON THE MECHANISM AND CHEMISTRY ASPECTS OF CHEMICAL DISPERSION
Canevari, G.P. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 5-17. ASTM Special Technical Publication 659.

Surfactants, Dispersion, Behavior, Physical aspects, Chemical effects

The methodology and role of the surface active agent in the generation of finely dispersed oil droplets are reviewed. The incentives, concerns, and current status of chemical dispersion are discussed.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1298
PROTECTION OF THE SOIL, WATER, SEWERS AND CLARIFICATION PLANTS FROM THE USE OF MINERAL OILS [in German]
Eiling, R. 1978.
Schmierungstechnik 9(5):148-152.

Fate, Environmental effects, Toxicity, Groundwater, Soil

Various properties of mineral oils are described, including their penetration powers on different constituents of the environment and their toxic, noxious, corrosive and explosive properties.

[from Chemical Abstracts 89(24):#203530h. 1978]

79D-1299
INVESTIGATIONS OF PHYSICAL PROCESSES
Galt, J.A. 1978.
The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 7-20.

Physical aspects, Physical effects, Amoco Cadiz spill, Crude oil, Movement, Distribution, France

The physical processes that affect the behavior of oil in the marine environment include those processes that control the movement and mixing of ocean waters and those processes that affect the oil and its distribution as it floats in the water. The data collected at the Amoco Cadiz spill site will prove useful in the development of conceptual algorithms to describe fundamental processes of oil movement and will contribute to the further development of oil spill forecasting models.

79D-1300
INVESTIGATIONS OF BEACH PROCESSES
Gundlach, E.R., and M.O. Hayes. 1978.
The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 85-196.

Amoco Cadiz spill, Shorelines, Beaches, Sediments, Crude oil, Distribution, Physical aspects, France

Coastal processes and geomorphology played a major role in the dispersal and accumulation of the Amoco Cadiz oil once it came ashore. The details of oil erosion and burial were determined by resurveying 19 permanent beach profiles which were established during the first few days of the spill.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1301
BEACH PROCESSES AND OIL SEDIMENT INTERACTIONS AT THE *AMOCO CADIZ* OIL SPILL SITE
Hayes, M.O., and E.R. Gundlach. 1979.
American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, DC, AAAS, 1979. p. 43. Abstracts.

Amoco Cadiz spill, Shorelines, Sediments, Crude oil, Distribution, Physical effects, France

Coastal processes and geomorphology played a major role in the dispersal and accumulation of oil spilled from the *Amoco Cadiz* once it came ashore. The details of oil erosion and burial were determined by surveying 19 permanent beach profiles on three separate occasions. Results of the findings are presented.

3. Social and Economic Aspects

79D-1302
PUBLIC KNOWLEDGE AND PERCEPTIONS OF THE EFFECTS OF THE *ARGO MERCHANT* OIL SPILL
Fricke, P., and J. Maiolo. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 169-175.

Oil spills, Socioeconomic effects, *Argo Merchant* spill

The title paper explores the perceptions that residents of Cape Cod, Martha's Vineyard and Nantucket have of the nature of effects of oil spills that occurred in the area in December 1976 and January 1977. It is believed that knowledge of these perceptions "needs to be incorporated into any efforts to inform the public and into any planning for the prevention of or response to oil spills."

79D-1303
TEN YEARS AFTER. WHAT "THE SPILL" REALLY DID TO ECOLOGY AND SANTA BARBARA
Hayes, S. 1979.
Pacific Oil World 72(1):76-78.

Santa Barbara Channel, Oil spills, Socioeconomic effects, Oil industry, *Tourism

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

The impact of the 28 January 1969 blowout in the Santa Barbara Channel on the ecology movement and its consequences to the oil industry are examined from an industry perspective. The incident is claimed to have had little impact on tourism in Santa Barbara.

[from Petroleum Abstracts 19(33):#266,505. 1979]

79D-1304
ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM. FIRST ANNUAL REPORT: SYNTHESIS OF FINDINGS
Peat, Marwick, Mitchell and Co. 1978.
Report BLM-MM-78-04, Control DI-AA550-CT6-61. 160 p.

OCS, Development, Socioeconomic effects, Oil industry

This report "conveys the major theoretical, methodological, and substantive findings which have emerged from the first twelve months of the Alaska OCS Socioeconomic Studies program." Findings presented contributed to the second year program design and are described in brief. [possibly oil pollution related]

[from Government Reports Announcements 78(18):236. #PB-281 536. 1978]

79D-1305
TEXAS GULF SHRIMPS AWAIT IMPACT OF LARGEST OIL SPILL
Sullivan, T. 1979.
National Fisherman 60(6):3, 118.

Ixtoc I blowout, Fisheries, Economic effects, Contamination, Texas, *Shrimp industry

Possible economic impacts of the Ixtoc I well blowout and oil spill on the Texas shrimp industry are discussed. Tainting of the shrimp catch and the resultant devastation of the shrimp market is the area of greatest concern among shrimp fisheries.

79D-1306
POLLUTION: BIBLIOGRAPHY OF ENVIRONMENTAL ECONOMICS, VOL. 2
Turner, R.K., D.W. Pierce, and B.O. Pettman (eds.). 1977.
Bradford, England, MCB Books, 1977. __ p.

Economics, Economic effects, Cost analysis, Bibliographies, Book review

The title bibliography contains citations of numerous environmental problems including water and marine pollution and economic costs associated with various control strategies.

[from Environmental Pollution 18(2):171. 1978]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

4. Environmental Response and Recovery

[No entries.]

5. Baseline and Environmental Impact Studies

79D-1307
POLLUTION RESEARCH IN ARCTIC WATERS
Anon. 1979.
Northern Offshore 8(1):11-12.

Baseline studies, Offshore, Development, Alaska, Prudhoe Bay

Scientific investigations of Prudhoe Bay and the waters north of Alaska "will form the basis for a debate on the condition of these waters prior to petroleum activity."

[from Petroleum Abstracts 19(31):#266,006. 1979]

79D-1308
POLYNUCLEAR AROMATIC HYDROCARBONS IN BALTIMORE CANYON FISH
Brown, R.A., and R.J. Pancirov. 1979.
Environmental Science & Technology 13(7):878-879.

Baseline studies, PAH, Fish, OCS, Offshore, Development, Atlantic coast

A baseline study on the present levels of PAHs in fish of the Baltimore Canyon area off the east coast of the US was conducted in anticipation of future oil and gas activities. The results are tabulated and discussed.

79D-1309
WASHINGTON STATE REFINERIES: PETROLEUM, PETROLEUM DERIVATIVES AND WASTEWATER EFFLUENT CHARACTERISTICS
Pizzo, T.T., T.L. Johnson, and G.W. Harskman. 1978.
Report EPA/600/7-78/040, Contract NOAA-03-6-022-35189. 186 p. Final report.

Environmental effects, Oil industry, Crude oil, Refining, Petroleum products, Wastewaters, Washington, Puget Sound

The title study describes in detail the types of petroleum and petroleum derivatives which could potentially reach the waters of Puget Sound through disposition of crude oils, refined products and wastewater effluent associated with the six Puget Sound refineries. Refining and waste treatment processes are described in detail.

[from Government Reports Announcements 78(22):130. #PB-283-401. 1978]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1310
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. FINAL REPORTS OF PRINCIPAL INVESTIGATORS. VOLUMES 1, 2, 3. BIOLOGICAL STUDIES.
US National Oceanic and Atmospheric Administration. 1978.
Reports NOAA-78110701,2,3. Vol. 1, 494 p.; Vol. 2, 960 p.; Vol. 3, 623 p.
Final reports.

OCS, Development, Baseline studies, Aquatic environment, Marine organisms, Alaska

Three volumes of final reports include eleven baseline studies of aquatic fauna and flora which will be used to determine potential effects of petroleum development on the Alaskan OCS.

[from Government Reports Announcements 79(4): 94. #PB-289-154,5,6. 1979]

79D-1311
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS, OCTOBER-DECEMBER 1977. VOLS. I & II.
US National Oceanic and Atmospheric Administration. 1978.
Report NOAA-78053001, 2.Vol. I, 486 p.; Vol. II, 607 p. Quarterly report.

Baseline studies, OCS, Environmental effects, Development, Oil transport

Reports containing baseline studies are compiled in this quarterly report. This baseline data will be used to assess the potential environmental impact that might result from development of Alaska's OCS petroleum resources and from transport of crude oil.

[from Government Reports Announcements 78(20):217. #PB-283 679,680. 1978]

79D-1312
GUIDELINES FOR THE DESIGN AND CONDUCT OF OCS OIL AND GAS DEVELOPMENT BASELINE STUDIES
US Outer Continental Shelf Environmental Studies Advisory Committee. 1976.

Baseline studies, OCS, Development, Environmental effects

This report is intended to provide a set of guidelines for the design of OCS baseline studies for use by government agencies or private organizations.

[from Marine Geology 24(4):338. 1977]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1313
MARINE BIOLOGICAL EFFECTS OF OCS PETROLEUM DEVELOPMENT
Wolfe, D.A. 1978.
Report NOAA-TM-ERL-OCSEAP-1, NOAA-78102601. Technical memo.

OCS, Development, Biological effects, NOAA, *OCSEAP, *Proceedings

The title document contains the proceedings of the first formal scientific review of the Biological Effects Studies managed by NOAA's OCS Environmental Assessment program, (OCSEAP).

[from Government Reports Announcements 79(4):94. #PB-288 935. 1979]

6. Legal and Regulatory Aspects

79D-1314
A FEE COLLECTION MECHANISM FOR THE OIL POLLUTION LIABILITY AND COMPENSATION LEGISLATION
Christensen, M.W., and M.V. Froehlich. 1978.
Report CG-WEP-78-1, Contract 11 234 6981. 67 p. Final report.

Liability, Regulations, Legislation, *Superfund

The title report presents a study of the fee collection mechanism for the comprehensive oil pollution fund. This proposed $200 million "superfund" to cover cleanup and compensation costs will be sustained by a fee not to exceed $.03/bbl of all oil domestically produced or imported. Separate collection schemes are proposed for domestic crude oil, imported crude oil and products, and exported crude oil.

[from Government Reports Announcements 79(6):161. #AD-A061 403. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

7. General Aspects

79D-1315
HOW MUCH ENVIRONMENTAL DAMAGE WAS CAUSED BY THE OIL SPILL THAT RESULTED WHEN THE SUPERTANKER AMOCO CADIZ RAN AGROUND OFF THE COAST OF BRITTANY ON MARCH 16, 1978?
Anon. 1979.
Sea Secrets 23(1):2.

Oil spills, Environmental effects, Contamination, Spill removal, Amoco Cadiz spill, France

A concise and non-technical summary of the major effects of the Amoco Cadiz spill is given including amount of oil removed, environmental effects, climatic influences, and details about the ship itself.

79D-1316
PROCEEDINGS OF THE FIRST AND SECOND USA-USSR SYMPOSIA ON THE EFFECTS OF POLLUTANTS UPON AQUATIC ECOSYSTEMS. VOLUME I. DULUTH, MINNESOTA, USA SYMPOSIUM, OCTOBER 21-23, 1975. VOLUME II. BOROK, JAROSLAVL OBLAST, USSR SYMPOSIUM, JUNE 22-26, 1976
Akademiya Nauk, SSSR, and Environmental Research Lab, Duluth. 1978.
Report EPA/600/3-78/076. 413 p.

Biological effects, Biodegradation, Fate, Movement, Aquatic environment

The papers in these proceedings focus upon methodology, historical aspects, microbial and abiotic degradation processes, effects of toxicants, trace metal problems, proposed species indices and studies on the fate and transport of pollutants. [possibly oil pollution related]

[from Government Reports Announcements 79(02):72. #PB-287 219. 1979]

79D-1317
THE CRISTOS BITAS AFFAIR
Bourne, W.R.P. 1979.
Marine Pollution Bulletin 10(5):122-123.

Oil spills, Biological effects, Birds, Spill response, *Cristos Bitas spill

The events following the October 1978 wreck of the Cristos Bitas are briefly outlined, and the contents of a report entitled Oil Pollution of West Wales by the Cristos Bitas, 21 October-20 November 1978 are summarized. The report describes the effects of the spill on the bird and grey seal populations and the action taken on their behalf. Recommendations are made for future action regarding response to oil spills.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1318
IN THE WAKE OF THE ARGO MERCHANT, PROCEEDINGS OF A SYMPOSIUM HELD JANUARY 11-13, 1978
Center for Ocean Management Studies. 1978.
Kingston, Rhode Island, University of Rhode Island, Center for Ocean Management Studies, 1978. 181 p.

Oil spills, Biological effects, Chemical effects, Physical effects, Socioeconomic effects, *Proceedings, Argo Merchant spill

The title Proceedings presents 25 articles dealing with physical, chemical, biological, socioeconomic, and response studies carried out following the wreck of the Argo Merchant in December 1976. The purpose of the document is "to serve as a historic document and assist various individuals and agencies in responding to future spills."

79D-1319
A SMALL OIL SPILL AT WEST FALMOUTH
Conner, W. 1979.
Report EPA 600/9-79-007. 28 p. Energy/Environment R & D Decision Series.

Florida spill, Fate, Environmental effects, Biological effects, Benthos, Intertidal zone, Marshes, Marine organisms, Massachusetts

This report on oil and its fate and effects in coastal environments focuses on the Florida tanker spill which occurred at West Falmouth, Massachusetts in September 1969. Long-term studies by H. Sanders and M. Blumer of Woods Hole Oceanographic Institution comprise "probably the most rigorous and comprehensive investigation ever made of a single spill event." The spill resulted in heavy contamination of biologically sensitive subtidal areas, tidal flats, and salt marshes, and the sublethal effects of chronic oil pollution were apparent for at least seven years after the spill.

79D-1320
ECOLOGICAL EFFECTS OF DISPERSANTS IN THE UNITED KINGDOM
Cowell, E.B. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 277-292. ASTM Special Technical Publication 659.

Dispersants, Toxicity, Environmental effects, Torrey Canyon spill, UK, Marshes, Rivers, Lakes

Toxicity problems associated with dispersant use in the Torrey Canyon spill are reviewed, as are subsequent developments to reduce toxicity and to increase the safe application of dispersants. Although newly developed dispersant formulations are environmentally much safer, even these materials should not be used in salt marsh and mangrove areas, or in freshwater rivers and lakes unless they are very large.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1321
MARINE POLLUTION AND PROPERTIES OF THE BAY OF ELEUSIS [in Greek]
Friligos, N. 1978.
Chemika Chronika, Genike Ekdosis 43(2):45-47.

Bays, Industries, Petroleum products, Pollution control, *Greece

"Pollution of the Bay of Eleusis (Greece) by sewage and industrial wastes was dicussed. Heavy metals, petroleum products, and insecticides were the main pollutants. Six proposals for the correction of the situation were made."

[from Chemical Abstracts 91(4):#26989h. 1979]

79D-1322
PETROLEUM AND PETROCHEMICALS
Haakansson, H., and A. Jernelov. 1977.
Report IVL-B-346. 36 p. (NTIS Report PC A03/MF A01)

Crude oil, Petrochemicals, Biological effects, Environmental effects, Health hazards, *Bioaccumulation

"The review covers biological, ecological, and medical effects of crude oil and petrochemicals." Special attention is given to the accumulation of oil in different organisms and consideration of the resulting effects on biological populations and the ecosystem.

[from Chemical Abstracts 89(18):#151933v. 1978]

79D-1323
PROGRAM REVIEW PROCEEDINGS OF: ENVIRONMENTAL EFFECTS OF ENERGY RELATED ACTIVITIES ON MARINE/ESTUARINE ECOSYSTEMS
Hall, C., and W. Preston. 1977.
Report EPA/600/7-77/111. 303 p.

Environmental effects, Movement, Monitoring, Marine environment, Estuaries, *Proceedings

An integrated environmental science research program was suggested for five major areas: Pollution characterization and monitoring; environmental transport processes; health effects, ecological effects; and integrated assessment. This report is a compilation of proceedings from the review session. [possibly oil pollution related]

[from Government Reports Announcements 78(23):128. #PB-284 296. 1978]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1324
THE AMOCO CADIZ OIL SPILL, A PRELIMINARY SCIENTIFIC REPORT
Hess, W.N. (ed.). 1978.
NOAA/EPA Special Report. Washington, DC, US Government Printing Office, 1978. vi + 281 p.

Amoco Cadiz spill, Spill cleanup, Remote sensing, Beaches, Distribution, Chemical effects, Biological effects, France

This document provides a preliminary account of the US scientific efforts in response to the Amoco Cadiz oil spill during the period from 19 March to 15 May 1978. Observational objectives established by the US team were: Aerial photographic mapping and ground surveys of impacted beaches; statistical mapping of the distribution of oil on the water; surveys of the concentration of oil in subsurface water; evaluation of the effect of weathering on the composition of surface oil; evaluation of the long-term effects of weathering on the composition of oil in sediments from tidal flats and beaches; evaluation of the biological consequences of the spill; and observation and assessment of cleanup techniques. Individual papers are abstracted separately in this issue OPA.

79D-1325
THE U.S. STUDIES OF THE AMOCO CADIZ WRECK
Hess, W.N. 1979.
American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, DC, AAAS, 1979. p. 43. Abstracts.

Amoco Cadiz spill, Spill cleanup, Distribution, Chemical effects, Biological effects, NOAA, EPA, France

An overview of the Amoco Cadiz spill and US scientific involvement is given. Scientists from NOAA, EPA, and several universities have worked with French scientists to map the distribution of oil on the water, in the sediments, and on the beach; to study the changing chemistry of the oil; to study the biological effects of the oil; and to study the cleanup procedures used by the French authorities.

79D-1326
EXPERIMENTAL ECOSYSTEMS AS A MEANS OF EVALUATING THE FATE AND EFFECT OF CONTAMINANTS IN AQUATIC ECOSYSTEMS
Hodson, P.V., and E.S. Millard. 1978.
Canada, Fisheries and Marine Service, Technical Report 818:65-87.

Aquatic environment, Contamination, Fate, Biological effects, Ecosystems

"A review with 18 references." [possibly oil pollutuon related]

[from Chemical Abstracts 91(1):#841d. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1327
AIR AND WATER POLLUTION - ANNUAL REPORT FY 74-76
Kirchoff, W.H., and E. Myers. 1978.
Report NBS-TN-963. 390 p.

Analytical techniques, Concentrations, Detection, Sediments, Hydrocarbons

Oil pollution related subjects presented include development of Standard Reference Materials for evaluation of instrument accuracy, methods for measuring the concentration of pollutants in water and sediments, and measurement evaluation and compilation of physical and chemical properties of known pollutants.

[from Government Reports Announcements 79(4):61. #PB-287 493. 1979]

79D-1328
A LITERATURE REVIEW - PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 1. OCCUPATIONAL HEALTH AND SAFETY ASPECTS OF DIESEL FUEL AND WHITE SMOKE GENERATED FROM IT
Liss-Suter, D., and R. Mason. 1978.
Report AD-A056 018, Contract DAMD17-77-C-7020/ 64 p. Final report.

Health hazards, Safety, Toxicity, Bibliographies, *Diesel fuel

Literature is reviewed covering diesel fuel analysis, physical and chemical properties, human and animal toxicology, mammalian pharmacokinetics, industrial standards, and occupational hazards and white smoke. [possibly oil pollution related]

[from Government Reports Announcements 78(21):93. #AD-A056 018. 1978]

79D-1329
EFFECTS OF PETROLEUM ON ARCTIC AND SUBARCTIC ORGANISMS. V. 1: NATURE AND FATE OF PETROLEUM. V. 2: BIOLOGICAL EFFECTS
Malins, D.C. (ed.). 1977.
New York, San Francisco, London, Academic Press, 1977. V. 1:xvii + 321 p.
V. 2:xx + 500 p.

Biological effects, Fate, Weathering, Birds, Fish, Biodegradation, Arctic, Cold climates, Book review, *Transport

The purpose of these two volumes is "to compile and evaluate current knowledge on the effects of petroleum on arctic and subarctic marine environments." Subjects include transport, weathering, biodegradation, and various biological effects on birds, fish, and other marine organisms.

[from Limnology and Oceanography 24(1):199. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1330
THE EFFECTS OF OIL ON MARINE LIFE
Mertens, E.W., and J.R. Gould. 1979.
Erdoel, Kohle, Erdgas, Petrochemie 32(4):162-164.

Environmental effects, Offshore, Production, Marine organisms

"A review with 29 references."

[from Chemical Abstracts 91(5):#33569z. 1979]

79D-1331
GENERAL REPORT ON WATER POLLUTION IN SETO INLAND SEA [in Japanese]
Nakanishi, H. 1976.
Yamaguchi Sangyo Igaku Nempo 22:16-33.

Oil industry, Petrochemicals, Environmental effects, Fisheries, Japan, *Seto Inland Sea

A ten-fold increase in industrial effluents occurred between 1955 and 1973 from various industries including the petroleum and petrochemicals industries. The fishing industry has been the most affected by pollution.

[from Chemical Abstracts 89(22):#185659q. 1978]

79D-1332
EFFECTS OF DISPERSANT USE ON SHORE LIFE
Nelson-Smith, A. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 253-265. ASTM Special Technical Publication 659.

Dispersants, Spill cleanup, Environmental effects, Shorelines, Marine organisms, Toxicity, UK, Guidelines, Torrey Canyon spill

Damage to seashore life that resulted from the Torrey Canyon spill is not representative of dispersant use, as shown by recent examples of dispersant application around Great Britain. This paper discusses newer, less toxic dispersants and their ecological effects and presents general guidelines for dispersant use limitations in certain coastal environments.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1333
SOME DATA ON THE CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS OF THE ENVIRONMENT [English summary]
Shabad, L.M. 1979.
Magyar Onkologia 23(1):3-11.

PAH, Distribution, Soil, Freshwater, Seawater, Plants

"A review with no references on carcinogenic aromatic hydrocarbons in the soil, natural waters, seeds, etc." [possibly oil pollution related]

[from Chemical Abstracts 91(7):#50356v. 1979]

79D-1334
ECOLOGICAL CONSEQUENCES OF CHOICES IN THE FIELD OF ENERGY
Zorzoli, G.B. 1978.
Acqua Aria 1:13-16.

Fossil fuels, Industries, Environmental effects

"A review with no references on the impact on the environment of the use of fossil fuels and atomic energy in power generation." [possibly oil pollution related]

[from Chemical Abstracts 89(26):#219923z. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

1. Biodegradation

79D-1335
STUDY OF FACTORS AFFECTING PETROLEUM BIODEGRADATION IN SOIL [in Russian]
Andreson, R.K., and L.A. Propadushchaya. 1979.
Korroziya i Zashchita v Neftegazovoi Promyshlennosti 3:30-32.

Biodegradation, Microorganisms, Soil

Small doses of EPN-5 stimulated the growth of spore-forming microorganisms and enhanced petroleum biodegradation whereas larger doses decreased their numbers and those of bacteria. Superphosphate (10 mg P_2O_5/100 g soil) also increased the count of petroleum degrading microorganisms. The mechanism of microbial action is discussed.

[from Chemical Abstracts 91(1):#2694g. 1979]

79D-1336
BIOLOGICAL DEGRADATION OF PETROLEUMS [in Russian]
Aref'ev, O.A., M.N. Zabrodina, I.K. Norenkova, M.N. Karpenko, et al. 1978.
Izvestiya Adademii Nauk SSSR, Seriya Geologicheskaya 9:134-139.

Biodegradation, Crude oil, Concentrations, Hydrocarbons, Chemical analysis

The composition of petroleum before and after bacterial degradation was examined using gas-liquid chromatography and mass spectroscopy. The concentrations of n-alkanes, isoprenoids, and isoparaffins decreased after degradation due to transformation into paraffins-naphthenes and naphthenes.

[from Chemical Abstracts 89(26):#217615b. 1978]

79D-1337
AROMATIC HYDROCARBONS: DEGRADATION BY BACTERIA AND FUNGI
Cerniglia, C.E., and D.T. Gibson. 1978.
Oil and Oil Shale Chemistry, Proceedings of the Symposium. O.P. Strausz and E.M. Lown (eds.). New York; Verlag Chemie International, 1978. p. 191-210.

Biodegradation, Aromatic hydrocarbons, Bacteria, Fungi

"A review with 52 references."

[from Chemical Abstracts 91(3):#14623w. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1338
PRELIMINARY RESEARCH ON THE MARINE DISTRIBUTION OF HYDROCARBON-OXIDIZING MICROORGANISMS [English summary]
De Domenico, M. 1977.
Bolletino di Pesca Piscicolotura e Idrobiologia 30( ):157-176.

Biodegradation, Bacteria, Distribution, Hydrocarbons, Italy

The results of a study on the occurrence of hydrocarbon-oxidizing bacteria in water and sewer lines in several places around Italy are presented, and the literature on the subject is reviewed.

[from Biological Abstracts 67(1):#189. 1979]

79D-1339
BIODETERIORATION OF OIL SPILLS (A BIBLIOGRAPHY WITH ABSTRACTS)
Harrison, E.A. 1979.
Report NTIS/PS-79/0009. 131 p. Report for 1964-Jan. 79. (Supersedes NTIS/PS-78/0043, NTIS/PS-77/0046, NTIS/PS-76/0032, and NTIS/PS-75/152.)

Biodegradation, Oil spills, Bacteria, Algae, Spill cleanup, Bibliographies

Citation and abstract topics include algae, bacteria, hydrocarbons, petroleum degradation, oil spills, beach cleanup, and microbial degradation as related to biodeterioration of oil spills. This issue contains 124 abstracts, 6 of which are new.

[from Government Reports Announcements 79(7):76. #NTIS/PS-79/0009. 1979]

79D-1340
DEGRADATION OF CRUDE OIL BY USING MARINE MICROORGANISMS. EFFECT OF VITAMINS [in Japanese]
Hirayama, M., S. Nagata, and G. Kondo. 1978.
Mizu Shori Gijutsu 19(10):919-921.

Biodegradation, Crude oil, Microorganisms, *Vitamins

Addition of B-vitamins, biotin, and α-lipoic acid were tested for their effects on biodegradation of crude oil by marine microorganisms. The addition of B-vitamins increased degradation rates for n-alkanes; the other additives had no effect.

[from Chemical Abstracts 91(6):#44211c. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1341
INTERACTION OF AEROBIC AND ANAEROBIC BACTERIA IN PETROLEUM BIODEGRADATION
Jobson, A.M., F.D. Cook, and D.W.S. Westlake. 1979.
Chemical Geology 24(3-4):355-365.

Biodegradation, Bacteria, Metabolism

The relations between aerobic petroleum-degrading and anaerobic sulfate-reducing bacteria in oil degradation are presented. The results support the hypothesis that sulfate-reducing bacteria cannot initiate oil degradation but rather grow on the residues produced by aerobic degradation.

[from Chemical Abstracts 91(4):#23494g. 1979]

79D-1342
METHOD FOR CONDITIONING FRESH AND SEA WATERS FROM OIL
Marconi, W., N. Oddo, and L. Degen. 1977.
US Patent 4,042,495

Biodegradation, Oil removal, Microorganisms, Spill cleanup, Patent

Hydrocarbons are removed from surface waters by scattering a nutrient salt containing nitrogen and phosphorus on the contaminated area in a form readily assimilable by microorganisms capable of metabolizing hydrocarbons. The nutrient particles are made buoyant by means of a surface treatment with paraffin.

[from Energy Research Abstracts 3(3):625.#5975. 1978]

79D-1343
THE DEGRADATION OF HYDROCARBONS BY MUTANT MICROORGANISM
Rogers, J. 1977.
Genesis of Petroleum and Microbiological Means for Its Recovery. Papers Presented at the Microbiology Group Symposium, 1976. London, Institute of Petroleum, 1977. p. 76-82.

Biodegradation, Petroleum products, Microorganisms, Hydrocarbons, *Mutant bacteria

"The hydrocarbon-degrading bacterial products are composed of a mixture of complementary strains of mutant adapted microorganisms which will degrade oil, oil products, and residues including tar balls in a permanent, nontoxic manner. The Petrobac I system eliminates crude oil from soil and beaches by emulsification and solubilization. Petrobac II system contains an absorbent which sorbs both slick and microorganisms and sinks below the surface where degradation is complete."

[from Chemical Abstracts 89(24):#203628. 1978]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1344
EFFECT OF A CHEMICAL DISPERSANT ON MICROBIAL UTILIZATION OF PETROLEUM HYDROCARBONS
Traxler, R.W., and L.S. Bhattacharya. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 180-188. ASTM Special Technical Publication 659.

Biodegradation, Dispersants, Microorganisms, Crude oil, Hydrocarbons

Unless mechanically or chemically dispersed in the water column, hydrocarbons or crude oils are not oxidized by the natural seawater microbial populations. Results of experiments are presented which show that the dispersant Corexit 9527 enhances bacterial metabolism of crude oils and pure hydrocarbons in nonagitated seawater systems, by dispersing the oil and hydrocarbon droplets into the water column as discrete droplets that can be attacked by bacteria.

79D-1345
MICROBIAL DEGRADATION OF PETROLEUM HYDROCARBONS
Westlake, D.W.S., F.D. Cook, and A.M. Johnson. 1978.
Report EPA/600/7-78/148. 79 p.

Biodegradation, Hydrocarbons, Shorelines, Sediments, Bacteria, Puget Sound

Microbial population response to Prudhoe Bay oil were investigated. Samples were tested from the water column, beach, and sediments representing the diverse marine shoreline environments found in northern Puget Sound and the straits of San Juan de Fuca. All sites studied yielded psychotropic bacterial populations which, in the presence of added nitrogen and phosphorus, were able to bring about changes in the n-alkane components of Prudhoe Bay oil.

[from Government Reports Announcements 79(5):75.#PB-288 406. 1979]

2. Physical and Chemical Processes

79D-1346
NEAR-BOTTOM TRANSPORT IN THE VICINITY OF THE ARGO MERCHANT: A SEABED DRIFTER STUDY
Collins, B.P., C.A. Griscom, and E.J. Hoffman. 1978.
In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 34-36.

Movement, Drift, Spill trajectories, Monitoring, Argo Merchant spill, *Near-bottom transport

Methods and results are described of experiments designed to determine the transport of Argo Merchant oil by near-bottom currents. Based on a 12% return of seabed drifters, it appeared that a near-bottom drift component existed to the northwest. The results corroborate the findings of earlier research in the area tested.

79D-1347
STUDIES ON DECAY OF SPILT CRUDE OILS. V. CHANGES OF SULFUR AND NITROGEN CONTENTS AND ULTRAVIOLET SPECTRA [in Japanese]
Higashi, K., and K. Hagiwara. 1978.
Mizu Shori Gijutsu 19(6):513-516.

Crude oil, Weathering, Chemical analysis, Source identification

Changes were investigated in eight crude oils floating on artificial seawater over a 360-day period. Some of the oils could be identified by the title analyses.

[from Chemical Abstracts 89(24):#199920r. 1978]

79D-1348
DISTRIBUTION OF HYDROCARBONS IN NARRAGANSETT BAY SEDIMENT CORES
Hurtt, A.C., and J.G. Quinn. 1979.
Environmental Science & Technology 13(7):829-836.

Hydrocarbons, Distribution, Fate, Sedimentation, Narragansett Bay

Sediment cores from Narragansett Bay indicated a decrease in surface sediment hydrocarbons from the Providence River to the mouth of the bay and a decrease with depth to about 20-25 cm. This depth is probably related to increased petroleum utilization at the end of the 19th century. The Providence River is the major source of anthropogenic hydrocarbons in bay sediments.

D. FATE OF OIL IN THE ENVIRONMENT

79D-1349
THE FATE OF STRANDED PELAGIC TAR ON A BERMUDA BEACH
Iliffe, T.M., and A.H. Knap. 1979.
Marine Pollution Bulletin 10(7):203-205.

Tar, Beaches, Fate, Distribution, Sediments, Physical aspects

"The major process involved in the removal of stranded petroleum residues or 'tar lumps' from sandy high energy beaches is the adsorption of sand and shell particles to the residues effecting a density change. This results in transport off the beach, sinking, and sometimes burial of tar in sublittoral sediments."

79D-1350
DROP SIZE DISTRIBUTIONS IN A TREATED OIL-WATER SYSTEM
Jasper, W.L., T.J. Kim, and M.P. Wilson. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 203-216. ASTM Special Technical Publication 659.

Dispersion, Behavior, Dispersants, Physical aspects

An experimental study of the title topic used two dispersants, Surflow-OW-1 and Corexit 9527, and incorporated the effects of input energy and shear rate. Peak values of the drop size distribution curve were found to decrease inversely with energy input; the oil-water interfacial area increased with the energy input; and Corexit 9527, the self mixing dispersant,had finer and better dispersion.

79D-1351
PHYSICAL AND CHEMICAL BEHAVIOR OF SMALL CRUDE OIL SLICKS ON THE OCEAN
Johnson, J.C., D.C. McAuliffe, and R.A. Brown. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 141-158. ASTM Special Technical Publication 659.

Oil slicks, Physical aspects, Behavior, Hydrocarbons, Dispersants, Atlantic Ocean

Described are the results of four small (under 1.7 m^3 volume) test spills in the North Atlantic, which were conducted to determine their physical behavior, and to obtain chemical data on specific hydrocarbon fractions of fresh slicks. The tests were conducted to develop data for understanding the effects of dispersants on future experimental slicks.

D. FATE OF OIL IN THE ENVIRONMENT

79D-1352
THE FATE OF SPILLED OIL
Leinonen, P.J. 1977.
University of Toronto, Ph.D. Dissertation. __ p.

Oil slicks, Hydrocarbons, Evaporation, Dispersion, Models, Physical aspects

The processes of evaporation and dissolution of an oil slick were studied experimentally and using computer models. "A technique was developed to study equilibrium multicomponent hydrocarbon-water-air systems. The compositions of the vapor, hydrocarbon, and aqueous phases were measured simultaneously and the fugacities of each hydrocarbon component in all 3 phases were calculated. The hydrocarbon and aqueous phase activity coefficients of the hydrocarbons also were determined."

[from Petroleum Abstracts 19(33):#266,506. 1979]

79D-1353
A STUDY TO CONDUCT EXPERIMENTS CONCERNING TURBULENT DISPERSION OF OIL SLICKS
Lin, J-T., M. Gad-el-Hak , and H-T. Liu. 1978.
Report FRC-112, USCG-D-54-78, Contract DOT-CG-6188-A. 108 p. Final report, October '76-April '78.

Oil slicks, Behavior, Dispersion, Sea surface, Models

Laboratory experiments were conducted to study the turbulent characteristics in the water boundary layers under the action of wind and waves and to study the action of breaking waves. For field application, empirical formulas were derived from the laboratory results.

[from Government Reports Announcements 78(25):128.#AD-A058 802. 1978]

79D-1354
DETERMINATION OF AIR-WATER HENRY'S LAW CONSTANTS FOR HYDROPHOBIC POLLUTANTS
Mackay, D., W.Y. Shiu, and R.P. Sutherland. 1979.
Environmental Science and Technology 13(3):333-337.

Hydrocarbons, Physical aspects, Solubility, Evaporation, *Air-water interface, *Henry's law

A system for the title determination involves measuring the pollutant concentration in only the water phase while the compound is being stripped isothermally from solution at a known gas flow rate. Determinations of H made for several hydrocarbons agree with available literature data. "The method may be suitable for elucidating the extent of sorption of volatilizing compounds in aqueous environments and quantifying the role of sorption in reducing volatilization rates."

[from Chemical Abstracts 91(4):#26962u. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1355
SURFACE CIRCULATION AND THE DISTRIBUTION OF PELAGIC TAR AND PLASTIC
Shaw, D.G., and G.A. Mapes. 1979.
Marine Pollution Bulletin 10(6):160-162.

Tar, Distribution, Drift, Pacific Ocean

"Pelagic tar and plastic have been measured along 158° W in the North Pacific. Maxima in the abundance of tar are associated with convergent meso scale and with small scale surface circulation features observed at the same time. There is no significant correlation between abundance of tar and that of plastic. It appears that this difference in distributions is the result of different input patterns or residence times."

79D-1356
THE METHODS FOR INVESTIGATING OIL AND HYDROCARBON OXIDATION IN SEA WATER
Tsyban, A.V. 1977.
Ambio Special Report, Vol. 5:263-267.

Oxidation, Crude oil, Hydrocarbons, Chemical analysis, Seawater

"A review with 29 references is presented."

[from Chemical Abstracts 89(16):#135314p. 1978]

79D-1357
AN EXPERIMENT FOR WATER SURFACE CONTAMINATION
Unno, H., and I. Inoue. 1978.
Chemical Engineering Science 33(11):1425-1428.

Oil slicks, Spreading, Behavior, Contamination

The effect of surface contamination on the spreading behavior of oil spilled on water was investigated. Three phases in the spreading pattern were noted; the degree of surface contamination had little effect on the spreading patterns during the first and second phases, but had great influence during the final phase.

[from Petroleum Abstracts 19(27):#264,929. 1979]

79D-1358
OIL LUMPS IN THE SEA [in German]
Walden, H. 1978.
Seewarte 39(3):128-130.

Tar, Marine environment, Sea surface, Weathering, Atlantic Ocean, *Sargasso Sea

This article summarizes research conducted by B.F. Morris, et al., as previously published in the book Marine Pollution Transfer [H.L. Windom, and R.A. Duce (eds.), Lexington, Massachusetts, Lexington Books, D.C.

Heath and Company, 1976]. At present, the Sargasso Sea contains some of the greatest concentrations of residual, tarry lumps, either floating or dispersed in the upper part of the water column, and the residence time of such particles ranges from months to years.

79D-1359
POLYCYCLIC AROMATIC HYDROCARBONS IN GULF OF MAINE SEDIMENTS AND NOVA SCOTIA SOILS
Windsor, J.G., Jr., and R.A. Hites. 1979.
Geochimica et Cosmochimica Acta 43(1):27-33.

PAH, Concentrations, Distribution, Fate, Soil, Sediments, *Pollutant transport

The title samples were analyzed for 10 PAHs using GC/MS. Total hydrocarbons ranged from 18 ppb for deep-ocean sediments to 120,000 ppb for Charles River sediments. Wide variations in soil PAHs were due to differences in soil porosity, lipophilic surface cover, and humic substance content. Two competitive transport mechanisms for the hydrocarbons are proposed.

[from Chemical Abstracts 91(4):#24312h. 1979]

3. Models, Simulations, and Predictions

79D-1360
POLLUTION BY PETROLEUM PRODUCTS. TRANSFER OF HYDROCARBONS IN WATER AND MIGRATION OF THE CONTAMINANTS IN THE AQUIFER [in French]
Bastien, F., P. Muntzer, and L. Zilliox. 1977.
Protection des Eaux Souterraines Captees pour l'Alimentation Humaine, Communications, Colloque National, Vol. 2:1-19.

Models, Petroleum products, Contamination, Movement, Groundwater

"A model is given for determining the speed and direction of migration of petroleum spills in an aquifer."

[from Chemical Abstracts 89(14):#117351u. 1978]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1361
A MODEL SYSTEM FOR THE STUDY OF SUBLETHAL POLLUTION EFFECTS ON MARINE ORGANISMS
Ducklow, H.W., and R. Mitchell. 1978.
Report TR-8, Contract N00014-76-C-0262. Interim report.

Models, Crude oil, Coral reefs, Biological effects, Sublethal effects, Bacteria

A microbial ecosystem consisting of coral and its associated bacteria can be used as a model for studying the effects of sublethal concentrations of pollution on microbial activities. An experimental flowing water system is described in which a Red Sea soft coral, *Heteroxenia fuscesens* is exposed to sublethal concentrations of crude oil. Such exposures resulted in a significant increase in the coral's mucous bacteria population levels.

[from Government Reports Announcements 79(7):83.#AD-A061 716. 1979]

79D-1362
THE BEHAVIOR OF FLOATING OIL FROM THE *ARGO MERCHANT*
Grose, P.L. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 19-21.

Models, Oil spills, Behavior, Movement, Drift, Predictions, Sea surface, *Argo Merchant* spill

The actual formation and drift of *Argo Merchant* oil are compared with those expected from predictive models. Measured differential velocities of the pancakes and surface waters were found to be consistent with a wave/oil interaction model that predicts oil velocities at twice the surface stokes drift. The thicknesses of the oil pancakes were not consistent with a model that predicted only static forces.

79D-1363
CAN OIL SPILL MOVEMENT BE PREDICTED?
Lissauer, I., and P. Welsh. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 22-27.

Models, Predictions, Movement, Drift, Sea surface, *Argo Merchant* spill

The title article provides a description of the forecasts given to the Coast Guard's Marine Safety Office (MSO) in Boston following the 15 December 1976 grounding of the *Argo Merchant*. Oil movement was predicted by use of a simple vector addition of the tidal velocity and 3.5% of the wind speed on an hourly basis. The lateral spread was determined from the tidal velocities. A series of 16 maps with supporting tables illustrates the model.

D. FATE OF OIL IN THE ENVIRONMENT

79D-1364
AN OIL SPILL RISK ANALYSIS FOR THE SOUTHERN CALIFORNIA (PROPOSED SALE 48) OUTER CONTINENTAL SHELF LEASE AREA
Slack, J.R., T. Wyant, and K.J. Lanfear. 1978.
US Geological Survey, Water Resources Investigations 78-80. vi + 93 p.

Predictions, Risk analysis, Models, Spill trajectories, Oil-gas leasing, Santa Barbara Channel, California

The title study analyzed the probability of spill occurrence, likely paths of the spilled oil and locations in space and time of biological and recreational resources likely to be vulnerable. The study concludes that the leasing of the proposed tracks will increase the expected number of spills by about 50-55% over that expected from existing federal leases. The probability that land will be contacted by a spill is increased by less than 17%.

79D-1365
SURFACE AND SUBSURFACE SPILL TRAJECTORY FORECASTING: APPLICATION TO THE ARGO MERCHANT SPILL
Spaulding, M.L. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 37-42.

Movement, Spill trajectories, Drift, Predictions, Spill response, *Argo Merchant* spill

Two models were constructed for predicting surface and subsurface trajectories of the *Argo Merchant* spill in order to provide the Coastal Zone Management and University of Rhode Island response teams with adequate data. A simple surface drift model was constructed to predict surface movement while a simple advective model was used to estimate subsurface trajectories. Surface and subsurface predictions were close to the actual spill motion.

79D-1366
RISK FORECASTING FOR THE ARGO MERCHANT SPILL
Wyant, T., and R.A. Smith. 1978.
In the Wake of the *Argo Merchant*. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 28-33.

Risk analysis, Models, Environmental effects, Predictions, Onshore impacts, *Argo Merchant* spill

An oil spill trajectory model developed for OCS environmental impact assessment is described as applied to the *Argo Merchant* spill. The model accurately predicted a low risk to various shoreline and marine resources over the long term. Differences between this "long term" risk model and short-term movement models are discussed.

79D-1367
AN EXPERIMENTAL STUDY OF DISPERSIVE SPREADING
Zimmerman, K.A., and R.W. Miksad. 1978.
Austin, Texas, Atmospheric Science Group, University of Texas, 1978.
iv + 80 p. (Report No. 46.)

Oil slicks, Spreading, Dispersion, Simulations, Predictions

An oscillating grid water tank was used to study the dispersive spreading of oil spills. A comparison of data generated from the laboratory experiments with actual oceanic measurements indicates that the water tank simulates on a small scale the ocean's turbulent surface layer. It is shown that the relative diffusion theory can be used to predict the dispersion of oil patches relative to their collective center of mass.

4. General Fate of Oil

79D-1368
SEASONAL DISTRIBUTION, TRAJECTORY STUDIES, AND SORPTION CHARACTERISTICS OF SUSPENDED PARTICULATE MATTER IN THE NORTHERN PUGET SOUND AREA
Baker, E.T., J.D. Cline, R.A. Feely, and J. Quan. 1978.
Report EPA/600/7-78/126. 156 p.

Crude oil, Distribution, Movement, Adsorption, Simulations, Sediments, Puget Sound

The title study focuses on the spatial and seasonal distributions of suspended particulate matter and its adsorption characteristics relative to Alaskan crude oils. The composition and abundance of hydrocarbons associated with suspended matter was evaluated at five locations. Laboratory measurements were also performed under simulated natural conditions to investigate short-term interaction between Prudhoe Bay crude and two local riverine sediments.

[from Government Reports Announcements 79(7):97.#PB-288 791. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1369
NATURALLY OCCURRING HYDROCARBON SEEPS IN THE GULF OF MEXICO AND THE CARIBBEAN SEA
Geyer, R.A. 1978.
College Station, Texas, Texas A&M University, Department of Oceanography, 1978. 19 p.

Natural seepage, Biological effects, Fate, Hydrocarbons, Texas, Gulf of Mexico, Caribbean Sea

This booklet summarizes historical and contemporary evidence for the presence of major natural oil and gas seeps along the Texas Gulf Coast. Results of Texas A&M University biological and geological investigations are briefly summarized. These indicate that "persistent introduction of hydrocarbons over thousands of years into an ecosystem has not been deleterious to the marine environment."

79D-1370
FATE OF POLYCYCLIC AROMATIC HYDROCARBONS IN CONTROLLED ECOSYSTEM ENCLOSURES
Lee, R.F., W.S. Gardner, J.W. Anderson, J.W. Blaylock, and J. Barwell Clarke. 1978.
Report NSF/IDOE-78/109, Grants NSF-GX-39149, NSF-OCE76-84108. 8 p.

PAH, Fate, Biodegradation, Weathering, Zooplankon, Uptake, Sediments, Ecosystems, Cold climates

The title report describes findings on the effects of Prudhoe crude oil enriched with a number of PAH's on an ecosystem enclosure suspended in Saanich Inlet, Canada. Concentrations of various aromatics were determined in water, zooplankton, oysters, and sediments. Only naphthalenes were significantly degraded by microbes, up to 5% per day. Sedimentation and photochemical oxidation were responsible for the decrease in concentrations of the higher weight aromatics.

[from Government Reports Announcements 79(6):174.#PB-289 060. 1979]

79D-1371
THE USE OF FATE OF LUBRICANTS, OILS, GREASES, AND HYDRAULIC FLUIDS IN THE IRON AND STEEL INDUSTRY
Serne, J.C., and K. Wilson. 1978.
Report EPA/600/2-78/101, Contract EPA 68-02-1405. 344 p. Final task report, May 76-April 78.

Petroleum products, Fate, Disposal, Industries, Water quality, Solid wastes

Results of the title investigation indicate that for a typical 4 million ton/yr integrated plant, 1.2 million lb/mo (545,000 kg/mo) of oils, greases, and hydraulic fluids are used of which 10% enters the environment as air pollution, 9% as water pollution, and 44% as solid waste.

[from Government Reports Announcements 78(25):182. #PB-284 973. 1978]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

1. Biological Aspects

79D-1372
SEALS IN SHETLAND WATERS
Anderson, S.S. 1979.
The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 14. Abstract.

Development, Oil spills, Marine mammals, Biological effects, Scotland, *Sullom Voe, *Seals

"The actual and potential effects on Grey and Common Seals of oil pollution and disturbance from the development and running of the Shetland oil industry are assessed."

79D-1373
EFFECT OF SOME CHEMICAL AGENTS USED IN THE DRILLING OF OIL WELLS ON CASPIAN SEA FAUNA [in Russian]
Gulidaze, M.P., A.G. Kasymov, K.V. Shakhbazbekov, and R.Kh. Nadzhafova. 1978.
Izvestiya Vysshikh Uchebnykh Zavedenii, Neft i Gaz 21(9):99-102.

Drilling, Toxicity, Invertebrates, Fish, *Drilling fluids

Several chemical agents tested had toxic effects on invertebrates and fish.

[from Chemical Abstracts 91(4):#26983b. 1979]

79D-1374
THE IMPLICATION OF NORTH SEA OIL ON THE SEABIRD POPULATIONS OF SHETLAND
Johnston, J.Z., and P.K. Kinnear. 1979.
The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 12. Abstract.

Development, Biological effects, Birds, Statistics, Contingency planning, North Sea, Scotland, *Sullom Voe

The key species at risk are identified together with the likely sources of threat, and the possible biological implications of oil developments in Shetland and surrounding waters. The practicalities of existing oil spill contingency measures for seabirds are assessed. Statistics on bird populations and details on species susceptibility are presented.

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1375
BALANCED PROGRAM PLAN: ANALYSIS FOR BIOMEDICAL AND ENVIRONMENTAL RESEARCH. VOLUME 5, OIL SHALE TECHNOLOGY
US Energy Research and Development Administration. 1976.
Contract W-7405-ENG-38. 42 p.

Oil Shale, Environmental effects, Health hazards, Development

Twenty-three research projects are described as to scope, milestones, technology time frame, program unit priority, and cost. Definition of research programs includes: Pollutants, physical and chemical processes and effects, health effects, ecological processes and effects, and integrated assessment.

[from Energy Research Abstracts 3(4):847.#8043. 1978]

2. Physical and Chemical Aspects

79D-1376
GEOCHEMICAL POLLUTION OF THE ENVIRONMENT IN THE AREAS OF OIL-GAS PRODUCTION AND UNDERGROUND GAS HOLDERS
Lukashev, K.I., and A.V. Kudelskii. 1978.
Gas Industry and the Environment, Proceedings of a Symposium of the Committee on Gas, Economic Commission for Europe, 1977. Oxford, England, Pergamon Press, 1978. p. 145-149.

Production, Oil industry, Environmental effects, Groundwater

"A review with no references." [possibly oil pollution related]

[from Chemical Abstracts 89(24):#203133f. 1978]

3. Social and Economic Aspects

[No entries.]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

4. Legal and Regulatory Aspects

79D-1377
MUD, BRINE MAY BE CLASSIFIED HAZARDOUS WASTES
Pitts, J.P. 1979.
Drill Bit 28(4):23-24.

Oil fields, Drilling, Production, Oil industry, EPA, Regulations, *Drilling muds

The effects on the oil industry of proposed EPA regulations which would classify oil field mud and brine as hazardous wastes are discussed. Measures bring taken by the industry in response to the proposed regulations are outlined.

[from Petroleum Abstracts 19(30):#265,672. 1979]

5. General Aspects

79D-1378
OIL EXPLORATION EXPECTED OFF OREGON BY EARLY 1980'S
Anon. 1979.
Western Fisheries 98(1):32, 63-64.

Offshore, Development, Oil-gas leasing, Baseline studies, Oregon

Offshore exploration may be expected off Oregon by the early 1980's. Before granting leases, the BLM guarantees that such development will be environmentally compatible by providing for regional baseline studies and environmental impact assessments, and removing environmentally sensitive areas from leasable tracts.

79D-7379
OFFSHORE DRILLING. VOLUME 2. (A BIBLIOGRAPHY WITH ABSTRACTS)
Habercom, G.E., Jr. 1978.
Report NTIS/PS-78/0749, 118 p. Report for 1976-June 1978. (Supersedes NTIS/PS-77/0703, NTIS/PS-76/0627, NTIS/PS-75/540, and NTIS/PS-74/103.)

Offshore, Drilling, Oil wells, Environmental effects, Equipment, Legislation, Bibliographies

Drilling procedures, equipment, environmental aspects, and legal implications involved in oceanic mineral resources recovery are covered. This updated biliography contains 111 abstracts, 55 of which are new entries. [possibly oil pollution related]

[from Government Reports Announcements 78(20):144.#NTIS/PS-78/0749. 1978]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1380
ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO, 1976-1977
Jackson, W.B. 1977.
Report PB-283 890. 756 p. Annual report.

Oil fields, Crude oil, Environmental effects, Concentrations, Marine environment, Development

Of particular interest in this report comparing an active oil field with an unaltered area are the comparison of pollutant concentrations in the sediments and biota, and identification of those changes associated with oil and gas exploration and production. Topics include hydrocarbon pathways in major components of the marine ecosystem, and total organic carbon and carbon isotopes in sediments.

[from Government Reports Announcements 78(23):191.#PB-283 890. 1978]

79D-1381
REVIEW AND ANALYSIS OF OIL SHALE TECHNOLOGIES. VOLUME IV. ABOVE GROUND OR SURFACE TECHNOLOGY
Jee, C.K., J.D. White, S.K. Bhatia, and D. Nicholson. 1977.
Report FE-2343-6 (Vol. 4). 173 p.

Environmental effects, Oil shale, *Surface technology

"A review, with unknown references, of 6 processes." [possibly oil pollution related]

[from Chemical Abstracts 91(8):#59658c. 1979]

79D-1382
MANAGING OIL AND GAS ACTIVITIES IN COASTAL ENVIRONMENTS
Longly, W.L, R. Jackson, and B. Snyder. 1978.
Report FWS/OBS-78/54, Contract DI-14-16-0008-2152.75 p.

Environmental effects, Resource management, Coasts, Oil industry

Suggestions are offered to developers for mitigation of environmental disruption. Coastal ecosystems are categorized, characteristic vegetation is described, and management practices are discussed. Impacts from a wide variety of industry-related activities are presented.

[from Governmental Reports Announcements 78(23):151.#PB-283 677. 1978]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1383
OIL IN WASHINGTON: APPLICABILITY OF MODELS TO MARINE ENVIRONMENTAL MANAGEMENT QUESTIONS AND ECOLOGICAL IMPACTS
Oceanographic Institute of Washington. 1976.
Seattle, Washington, Oceanographic Institute of Washington, 1976. Vol. I.

Models, Oil spills, Socioeconomic effects, Resource management, Risk analysis, Puget Sound, Oil industry, Environmental effects

An assessment is given of the use of models to solve state and local governmental management questions which could arise from alternative developments of the petroleum industry in Puget Sound through 1985. The socio-economic impacts of potential oil spills are considered of primary importance. Risk, transport, and ecological models are developed and conclusions and recommendations are made.

79D-1384
THE GREENWICH FORUM
Sibthorp, M.M 1979.
Marine Pollution Bulletin 10(7):186-188.

Offshore, Development, North Sea, Pollution prevention, IMCO, Oil transport, Legislation, Law enforcement, Fisheries

A summary of the proceedings of the conference in May 1979 entitled, "Europe and the Sea: The Case For and Against a New International Regime for the North Sea and Its Approaches" is presented. Topics covered include Energy, Environmental Aspects, Technological Co-operation, Fisheries, Shipping, Surveillance, Enforcement and Defense, and Alternative Legal Regimes. [possibly oil pollution related]

79D-1385
AN OILSPILL RISK ANALYSIS FOR THE MID-ATLANTIC (PROPOSED SALE 49) OUTER CONTINENTAL SHELF LEASE AREA
Slack, J.R., and T. Wyant. 1978.
Report USGS/WRD/WRI-78/085, USGS/WRI-78-56. 79 p. Final report.

Oil spills, Risk analysis, OCS, Development, Atlantic Ocean

The relative environmental risks for developing different North Atlantic regions for oil are examined. Conclusions indicate that, assuming recoverable amounts of petroleum are found, the proposed development of tract 49 will increase the number of spills by about 20-25% over those expected from existing leases (sale 40).

[from Government Reports Announcements 79(5):179.#PB-288 401. 1979]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1386
BENEFITS DERIVED FROM THE OUTER CONTINENTAL SHELF ENVIRONMENTAL STUDIES PROGRAM ARE QUESTIONABLE
US General Accounting Office. 1978.
Report CED-78-93. 33 p.

OCS, Development, Production, Contingency planning

The Outer Continental Shelf Environmental Studies Program is costly and may do little toward minimizing environmental damage during oil and gas exploration, development and production in the OCS. Recommendations to improve effectiveness are presented, including how data might best be used in decision-making, what information is needed, and the type of plans necessary.

[from Government Reports Announcements 78(18):167.#PB-281 782. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

1. Tankers and Ships

79D-1387
OIL-SPILL SHIP/COASTAL TANKER IS MODEL TESTED
Anon. 1979.
Ocean Industry 14(7):59-60.

Tankers, Skimmers, Equipment, Design-engineering, Spill cleanup, Models

A novel wide-jaw vessel to clean up oil spills is described. The ship consists of a twin hull, connected aft by a hinge to form a tanker during normal operations, and a skimming veesel for spill cleanup operations. Model tests indicate that the craft will be operable as a skimmer under North Sea wave conditions.

79D-1388
TANK BARGE OIL POLLUTION STUDY
Bender, A., G.G. Brown, Jr., and J.M. Rosenbusch. 1978.
Report USCG-CG-M-2-78, Contract DOT-CG-71603-A. 69 p. Final report.

Oil transport, Oil spills, Pollution prevention, *Barges

This study determined and categorized the causes of tank barge oil spill incidents and the extent of the resulting pollution. Operational and causal patterns were identified, present pollution prevention efforts were examined, and means of reducing spill volumes and number of incidents were investigated.

[from Government Reports Announcements 79(1):129.#AD-A059 116. 1979]

79D-1389
REPORT OF THE CALIFORNIA INTERAGENCY TANKER TASK FORCE
California Resources Agency. 1978.
Sacramento, California Resources Agency, 1978. xvii + 82 p.

Oil transport, Oil transfer, Tankers, Ports, Oil terminals, Liability, Spill cleanup, Pollution prevention, Regulations

This report presents findings and recommendations of the California Interagency Task Force, relating to safe and pollution-free tanker operations, terminal, and port operations, and oil spill cleanup and liability provisions.

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1390
OPERATION BOHLEN
Cessou, M. 1978.
Petroleum Technology, N. 256:9-18.

Tankers, Oil transfer, Pollution prevention, *Hot water extraction

A new hot water extraction method was successfully applied to the recovery of oil from the shipwrecked East German tanker Bohlen, which sank on 14 October 1976. Recovery operations were completed within 5 months.

[from Petroleum Abstracts 19(30):#265,673. 1979]

79D-1391
SUPERTANKERS AND SUPERPORTS (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Habercom, J.E. 1978.
Report NTIS/PS-78/0815. 116 p. Report for 1970-June 1978. (Supersedes NTIS/PS-77/0701, and NTIS/PS-76/0592.)

Tankers, Ports, Development, Environmental effects, Offshore, Bibliographies

Construction and operation of supertankers and requirements for port facilities are reviewed in these reports gathered from international literature. Environmental aspects, offshore mooring sites, and harbor preparations are among the topics investigated. There are 110 abstracts in the report, 4 of which are new entries.

[from Government Reports Announcements 78(20):229.#NTIS/PS-78/0815. 1978]

79D-1392
TANKER OPERATIONS: A HANDBOOK FOR THE SHIP'S OFFICER
Marton, G.S. 1978.
Cambridge, Maryland, Cornell Maritime Press, 1978. 195 p.

Tankers, Pollution prevention, Equipment, Oil transport, Oil transfer, Manuals

The title book deals with several key aspects of tanker operations and contains the latest information on such subjects as pollution prevention, gas inerting systems, and special loading and unloading systems.

[from Marine Technology Society Journal 12(5):42. 1979]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1393
SPILL RISK ANALYSIS PROGRAM: METHODOLOGY DEVELOPMENT AND DEMONSTRATION - VOLUME 1
Stoehr, L.A., C.H. Morgan, F.J. Reiffler, and P.M. Tullier. 1977.
Report CG-D-21-77, Contract DOT-CG-31571-A, 1977. Final report.

Models, Tankers, Ships, Oil Spills, Risk analysis, USCG, Information systems, *PIRS

This report is an assessment of recently enacted and implemented merchant marine safety regulations. The methodology includes analytical modeling of collisions primarily in terms of physical parameters (vessel size, speed, maneuverability), and logical modeling of casualties using as a data base the USCG marine casualty reports. A preliminary analysis of the Coast Guard Pollution Reporting System (PIRS) is also included.

79D-1394
REPORT OF STUDY OF TANKER SAFETY AND POLLUTION PREVENTION REQUIREMENTS FOR US TANKERS IN DOMESTIC TRADE
US Coast Guard. 1978.
Report USCG-M-5-78. __ p.

Tankers, Safety, Pollution prevention, Risk analysis, Oil spills, Environmental effects, Segregated ballast, USCG

Risks are examined that are associated with the marine transportation of oil by US tank vessels, including vessel movements, and potential hazards to people, property, and the marine environment. Preventative actions and recommendations are presented including suggested discharge control measures, segregated ballast tanks, and tank cleaning procedures.

[from Government Reports Announcements 78(23):209.#AD-A057 607. 1978]

79D-1395
MARINE ACCIDENT REPORT - GROUNDING OF M/V DAUNTLESS COLOCOTRONIS IN MISSISSIPPI RIVER NEAR NEW ORLEANS, LOUISIANA ON JULY 22, 1977
US National Transportation Safety Board. 1978.
Report MA-GEN-370-78061, Contract MA-7-38020. 236 p.

Tankers, Oil spills, Mississippi River, *Accident report

A chronology of events leading to the title accident is presented. The probable cause was a fracturing of the vessel's bottom as it dragged over a sunken barge which had been declared a hazard to navigation but had not been marked by the owner nor removed by the Coast Guard.

[from Government Reports Announcements 78(24):199.#PB-284 333. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1396
MARINE ACCIDENT REPORT. SINKING OF THE M/V CHESTER A. POLING NEAR CAPE ANN, MASSACHUSETTS, JANUARY 10, 1977
US National Transportation Safety Board. 1978.
Report NTSB-MAR-78-7. 28 p.

Oil spills, Tankers, Massachusetts, *M/V Chester A. Poling

A summary of findings presented of the sinking of the title coastal tanker. Hull failure during a severe storm was caused by fracturing of a horizontal hull stiffener due to high stresses of heavy seas and improper distribution of ballast water.

[from Government Reports Announcements 79(01):159.#PB-286 549. 1979]

79D-1397
SPILLS WORSEN PROBLEMS IN GLOBAL OIL MOVEMENTS
Vielvoye, R. 1979.
Oil and Gas Journal 77(26):35-39.

Tankers, Oil spills, Statistics, Ballast, Oil discharges, Pollution prevention, International conventions

"Accidental oil spills during the past 18 months are listed and discussed. While statistically tankers are spilling less and less oil into the sea each year, the continuing spill incidents demonstrate that international conventions, enforced regulations, tanker equipment improvements, and navigational aids cannot entirely eliminate such spills....Some solutions to containing oil-spill pollution from both wreckage and ballast discharge are offered, including provisions of the international proposal for a Convention of Civil Liability for Oil Pollution Damage."

[from Petroleum Abstracts 19(27):#264,928. 1978]

2. Pipelines

79D-1398
OFFSHORE PIPELINE FACILITY SAFETY PRACTICES. VOLUME I - EXECUTIVE SUMMARY, VOLUME II - MAIN TEXT
Funge, W.J., K.S. Chang, and D.I. Juran. 1977.
Report DOT/MTB/OPSO-77/14, Contract DOT-05-60103. Vol. 1, 68 p.; Vol. 2, 563 p.

Pipelines, Offshore, Safety, Pollution prevention, Regulations

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

This report presents an evaluation of the state-of-the-art in the design, construction, operation, and maintenance of offshore pipeline facilities, an identification of potential hazards to operation, and a review of selected pipeline safety regulations. It includes an appraisal of existing foreign and domestic practices, a determination of their adequacy, an analysis of the need for additional research and development, and the need for regulatory changes.

[from Government Reports Announcements 78(19):114.#PB281 865,867. 1978]

79D-1399
SAFE SERVICE LIFE FOR LIQUID PETROLEUM PIPELINES
US National Transportation Safety Board. 1978.
Report NTSB-PSS-78-1. 43 p. Special Study.

Pipelines, Safety, Models, Pollution prevention

The title analysis revealed that insufficient data is available to support development of a model for determining when a pipeline has become so hazardous that its operation should be modified or terminated. Recommendations include improvement of DOT data gathering and analysis, strengthened federal pipeline regulations concerning LPG pipelines, and promotion of statewide "one-call" systems.

3. Loading and Offloading Facilities

79D-1400
THE FLOTTA OIL TERMINAL AND ITS EFFECTS ON THE MARINE ENVIRONMENT
Johnson, C.S. 1979.
The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 25. Abstract.

Oil terminals, Biological effects, Tankers, Oil transfer, Scotland, *Sullom Voe

The title paper concentrates on five major aspects of the Flotta Terminal: Risks from tanker movements and loading procedures; oily-water treatment systems; effluent discharge; general environmental philosophy; and "interpretation of exemption conditions from the Prevention of Oil Pollution Act of 1971 and the ongoing monitoring programme in the Flotta environs."

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1401
STUDY OF DEEPWATER PORT OIL TRANSFER CONTROL SYSTEMS
Robson, I.C., and W. Scherkenbach. 1978.
Report USCG-D-58-78, Contract DOT-CG-64503-A. 377 p. Final report.

Deepwater ports, Oil transfer, Pollution prevention, Tankers, *Transfer control systems

The title report deals with the description, reliability, and rating of oil transfer control systems. A numerical rating is presented which enables a comparison to be made between a proposed control system and a benchmark system. An equipment staging diagram, fault trees, and a failure mode and effects analysis are presented for the defined control system. [possibly oil pollution related]

[from Government Reports Announcements 78(3):124.#AD-A060 144. 1979]

4. Storage Facilities

79D-1402
STRATEGIC PETROLEUM RESERVE PLAN. EXPANSION OF THE STRATEGIC PETROLEUM RESERVE: AMENDMENT NO. 2, ENERGY ACTION DOE NO. 1
US Department of Energy. 1978.
Report DOE/RA-0032/2. 66 p.

Storage, Strategic Petroleum Reserve, Cost analysis, Environmental effects, Louisiana

Provisions are discussed of amendments which could double the present 500 million bbl reserve, and which would provide for the storage of 250 million bbl petroleum products for the U.S. Coast Guard. Implementation activities and a benefit/cost analysis are presented. [possibly oil pollution related]

[from Energy Research Abstracts 3(16):#36854. 1978]

79D-1403
STRATEGIC PETROLEUM RESERVE. SEAWAY GROUP SALT DOMES, BRAZORIA COUNTY, TEXAS. FINAL ENVIRONMENTAL IMPACT STATEMENT. VOLUMES 1, 2, 3
US Department of Energy. 1978.
Report DOE/EIS-0021 (Vol. 1,2,3). Vol. 1, 403 p.; Vol. 2, 357 p.; Vol. 3, 614 p.

Storage, Strategic Petroleum Reserve, EIS, Texas

The title final EIS discusses the environmental impacts of developing and operating a 100 million barrel crude oil storage facility at one or more of five candidate sites in the Seaway Group.

[from Energy Research Abstracts 3(20):48,746. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1404
STRATEGIC PETROLEUM RESERVE, SULPHUR MINES SALT DOME, CALCASIEU PARISH, LOUISIANA. FINAL ENVIRONMENTAL IMPACT STATEMENT
US Department of Energy. 1978.
Report DOE/EIS-0010. 622 p.

Storage, Strategic Petroleum Reserve, Oil transport, EIS, Louisiana

"This site specific EIS has identified particularly sensitive environmental parameters that have been investigated in detail for for Sulphur Mines, Louisiana site....A total of 453 barrels of oil are projected to be spilled during the project lifetime in transporting the crude oil."

[from Energy Research Abstracts 3(16):#36853. 1978]

79D-1405
FINAL ENVIRONMENTAL IMPACT STATEMENT. STRATEGIC PETROLEUM RESERVE. CAPLINE GROUP SALT DOMES, IBERIA, IBERVILLE, AND LAFOURCHE PARISHES, LOUISIANA. VOLUMES 1-4
US Federal Energy Administration. 1978.
Report DOE/EIS/0024 (V. 1,2,3,4). 1825 p.

Storage, Strategic Petroleum Reserve, EIS, Louisiana

A site-specific EIS is presented in four volumes for five candidate sites comprising the Capline Group of salt domes located in the Gulf Coast region of south central Louisiana.

[from Engery Research Abstracts 3(22):#51969-51972. 1978]

79D-1406
QUESTIONABLE SUITABILITY OF CERTAIN SALT CAVERNS AND MINES FOR THE STRATEGIC PETROLEUM RESERVE
US General Accounting Office. 1978.
Report EMD-78-65. 48 p.

Storage, Strategic Petroleum Reserve, Risk analysis, DOE

The title report discusses actions taken by DOE without adequate analysis to assure that risks of using certain salt caverns and mines for the strategic petroleum reserve were minimized. Possible ramifications of these actions and alternatives available are presented.

[from Government Reports Announcements 78(23):134.#PB-284 662. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

5. Legal and Regulatory Aspects

79D-1407
AN INTERVIEW WITH IMCO
Bartlett, T. 1977.
Dock and Harbour Authority 58(680):113-114.

IMCO, International conventions, Tankers, Oil terminals, Pollution control, Law enforcement, Spill cleanup

The text of an interview with the head of IMCO's Marine Environment Division, Mr. Yoshiosasamura, is presented. Topics of discussion include various provisions of the 1973 IMCO Convention, enforcement of the provisions, and the Regional Oil Combatting Centre at Malta.

6. General Aspects

79D-1408
BLACK YEAR FOR UK OIL POLLUTION
Anon. 1979.
Marine Pollution Bulletin 10(7):182-184.

Oil spills, Tankers, Statistics, Legislation, Biological effects, UK

The contents of the Advisory Committee on Oil Pollution of the Seas (ACOPS) Annual Report for 1978 are outlined. Statistics for spill incidents around the coasts of Britain and Ireland and legislative developments during 1978 are reviewed.

79D-1409
AD HOC STUDY OF CERTAIN SAFETY RELATED ASPECTS OF DOUBLE-BOTTOM TANKERS
Ervin R.D., P.S. Fancher, T.D. Gillespie, C.B. Winkler, and A. Wolfe. 1978.
Report UM-HSRI-78-18-1,2. Vol. 1, 79 p.; Vol. 2, 185 p. Final report.

Oil transport, Petroleum products, Safety, Design-engineering, *Tank trucks

The title two-volume study deals with inherent stability problems shown by "double-bottom" tank trucks, or those with multiple trailers. The study concludes that the double bottom "is a uniquely hazardous vehicle" and recommended that use of multiple trailers of present design be discontinued in Michigan. A modified version is suggested using existing technology. [possibly oil pollution related]

[from Government Reports Announcements 78(19):129.#PB-282 080,081. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1410
DEEPWATER PORTS INSPECTION METHODS AND PROCEDURES
Mastandrea, J.R., K.J. Gilbert, J.A. Simmons, and P.B. Kimball. 1978.
Report USCG-D-31-78, Contract DOT-CG-60670-A. 591 p. Final report.

Deepwater ports, Regulations, Pollution prevention, *Oil Transfer System

The title study provides information for future regulations dealing with pollution. It identifies and assesses inspection methods and procedures for the Oil Transfer System (OTS) of deep water ports. Recommendations are made for inspection methods and procedures that would provide an effective means of minimizing accidental oil spills from the OTS of deepwater ports in US waters.

[from Government Reports Announcements 78(20):199.#AD-A055 727. 1978]

79D-1411
OIL SPILLS AND TAR POLLUTION ALONG THE COAST OF KUWAIT
Oostdam, B.L., and V. Anderlini. 1978.
Safat, Kuwait, Kuwait Institute of Scientific Research, 1978. 54 p.

Statistics, Oil transport, Tankers, Tar, Oil spills, Coasts, Ballast, Pollution control, Kuwait

This report summarizes statistics on oil movement and oil pollution incidents in Kuwait waters, and presents the results of a tarball sampling and analysis program along Kuwait City beaches. Among the conclusions are that the number of oil spills in Kuwait is generally decreasing, that the average amount of oil spilled to oil transported is in a ratio of 1.5 ppm, well below the world average of 72 ppm, and that present monitoring and enforcement measures are inadequate, as are the facilities for tanker deballasting and slop disposal.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

1. Waste Treatment and Disposal Methods

79D-1412
PRELIMINARY EXAMINATION OF WASTE WATERS PRODUCED DURING AN IN SITU RETORTING OF TAR SANDS
Barbour, F.A., F.D. Guffey, and S.M. Dorrence. 1977.
Canadian Institute of Mining and Metallurgy Special Vol., No. 17. p. 743-748.

Wastewaters, Tar sands, Oil shale

The title study was conducted on a tar sand deposit in Utah. Organic constituents identified using GC/MS included carboxylic acids, particularly acetic acid, phenols, and lactones. Inorganic components were also identified. The results are compared with those from a similar analysis on product water from in situ recovery of oil shale.

[from Petroleum Abstracts 19(32):#266,226. 1979]

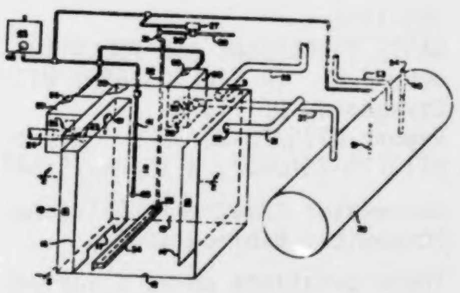
79D-1413
AUTOMATIC SYSTEM FOR TRAPPING AND REMOVING WASTE HYDROCARBONS FROM WASTEWATER
Bereskin, F.P., and J.J. Borowczyk. 1979.
US Patent 4,145,286

Wastewater treatment, Oil-water separation, Equipment, Design-engineering, Patent

Wastewater enters a chamber where oil, grease and other hydrocarbons are allowed to separate from the water. The separated water is discharged and new wastewater entering the chamber forces the hydrocarbon layer upward and through an outlet into a storage vessel.

[from Chemical Abstracts 91(4):#26849n. 1979]

4,145,286
AUTOMATIC SYSTEM FOR TRAPPING AND REMOVING WASTE HYDROCARBONS FROM WATER
Fred P. Bereskin, 117 Red Oak La., Highland Park, Ill. 60035, and Joseph J. Borowczyk, 116 West Central Blvd., Villa Park, Ill. 60181
Filed Aug. 1, 1977, Ser. No. 820,553
Int. Cl.^{2} B01D *21/24;* B03D *3/00*
U.S. Cl. 210—104 **7 Claims**



G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1414
DEPHENOLIZATION OF INDUSTRIAL WASTE WATER ON THE MACROPOROUS ADSORBENT AMBERLITE XAD-4
Bogdaniak, S.W. 1978.
Environmental Protection Engineering 4(3):201-209.

Wastewater treatment, Adsorption, Oil industry, *Phenol removal

Testing equipment for the title process is described, consisting of gravel and sorption columns connected in series. The process is suitable for oil industry and petrochemical wastewaters.

[from Chemical Abstracts 91(6):#44040w. 1979]

79D-1415
BIOLOGICAL EVALUATION OF BEST PRACTICABLE AND BEST AVAILABLE TREATMENT CONTROL TECHNOLOGY FOR PETROLEUM REFINERY WASTEWATERS
Burks, S.Z., and J.L. Wilhm. 1977.
Report PB-272281. 139 p.

Wastewater treatment, Oil industry, Filtration, Toxicity, Biological effects

Treatment systems were tested for the production of non-toxic effluents from petroleum refining wastewaters. Toxic effects of the test effluents were measured on fathead minnows and by benthic macroinvertebrate bioassay. BATEA, a sequential treatment process involving dual media filtration with activated charcoal absorption, improved final effluents. BPTC, a system without activated charcoal, did not significantly improve final effluent quality. A waste stabilization lagoon system produced a final effluent of comparable quality to that of BATEA.

[from Chemical Abstracts 88(20):#141,226g. 1978]

79D-1416
WASTE PROCESSING AND POLLUTION IN THE CHEMICAL AND PETROCHEMICAL INDUSTRIES. VOLUME 3. (A BIBLIOGRAPHY WITH ABSTRACTS)
Cavagnaro, D. 1978.
Report NTIS/PS-78/0826. 242 p. Report for 1977-July 1978. (Supersedes NTIS/PS-76/0607, NTIS/PS-75/541, and NTIS/PS-74/118.)

Wastewater treatment, Petrochemicals, Oil industry, Pollution prevention, Economics, Bibliographies

These citations cover a variety of topics including economics, control processes, pollution effects and abatement strategies of the chemical and petrochemical industries. Of the 235 entries, 123 are new.

[from Government Reports Announcements 78(21):97.#NTIS/PS-78/0826. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1417
BIODEGRADATION OF HIGH-LEVEL OIL-IN-WATER EMULSIONS
Davis, R.M. 1978.
Report CONF-780549-1, Contract W-7405-ENG-26. 18 p.

Biodegradation, Emulsions, Disposal, Wastewater treatment

A process is discussed for disposing of high-level oil-in-water emulsions used as coolants in metal machining operations. An aerobic stirred-bed reactor is used for the biodegradation of organic wastes and has demonstrated organic carbon removal efficiencies of 98%.

[from Energy Research Abstracts 3(20):#48257. 1978]

79D-1418
DEMULSIFIER FOR REMOVING EMULSIFIED PETROLEUM PRODUCTS AND VEGETABLE OILS FROM WATER
Gol'denfon, A.K., A.B. Stepanov, L.V. Shcherbakova, G.N. Semenov, et al. 1979.
USSR Patent 648,527

Wastewater treatment, Oil removal, Demulsification, Patent

Propylene oxide-ethylene oxide block copolymer was used for oil removal.

[from Chemical Abstracts 91(2):#9162r. 1979]

79D-1419
PRIMARY WASTEWATER TREATMENT AND OIL RECOVERY IN THE REFINING INDUSTRY
Gruett, J.L. 1978.
National Petroleum Refiners Association, Technical paper AM-78-43. 23 p.

Wastewater treatment, Oil removal, Oil-water separation, Refineries

"A review with no references."

[from Chemical Abstracts 89(24):#203465r. 1978]

79D-1420
HIGH RATE FILTRATION OF REFINERY OILY WASTEWATER EMULSIONS
Humenick, M.J., and B.J. Davis. 1978.
Journal Water Pollution Control Federation 50(8):1953-1964.

Wastewater treatment, Filtration, Emulsions, Refineries

The effectiveness of filtration of solids-stabilized oil-in-water emulsions with a dual-media-filter of anthracite and sand under a variety of conditions is assessed.

[from Chemical Abstracts 89(26):#220360v. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1421
STATUS OF OIL SHALE CONVERSION PROCESS TECHNOLOGY AND RESIDUALS MANAGEMENT
Hutchins, J. 1976.
Symposium on Management of Residuals from Synthetic Fuels Production, (first), Denver, Colorado, 25 May 1976.

Oil shale, Extraction, Disposal, Environmental effects, Solid wastes

Oil shale deposits of the west and some retorting processes are described. The waste and saleable products are discussed. "It is felt that most of the money spent on environmental studies is just wasted, and a personal view of priorities is offered." [possibly oil pollution related]

[from Energy Research Abstracts 3(5):1025. 1978]

79D-1422
THERMODYNAMIC ANALYSIS OF AN OIL RECLAMATION PROCESS
Jhawar, K.R., E.D. Grossman, H.L. Brown, and B.B. Hamel. 1977.
Report NTIS PC A09/MF A01. 200 p.

Waste oil treatment, Reclamation, Industries

"This study provides quantitative methodology for characterizing the energy utilization efficiency of waste oil reclamation processes."

[from Energy Research Abstracts 3(4):842.#7995. 1978]

79D-1423
DUAL MEDIA FILTRATION FOR TREATMENT OF REFINERY WASTE WATER
Kempling, J.C., T.E. Michniewicz, and J. Eng. 1976.
Water Pollution Research in Canada 11:57-61.

Wastewater treatment, Refineries, Filtration, Oil removal

Anthracite and sand were used to treat a refinery wastewater. The data were used to construct a dual-media filter capable of treating waste at a rate of 22,800 L/min (6,000 gal/min). Removal of oil and suspended solids were 79% and 55%, respectively.

[from Chemical Abstracts 89(26):#220366b. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1424
OIL REMOVAL FROM WASTEWATER OR SEWAGE
Kobiyama, S., and T. Kishi. 1978.
Japanese Patent Application 78 50,056

Wastewater treatment, Oil removal, Patent

Wastewater is treated in an apparatus containing a cylindrical deflector and a solvent, either petroleum ether, petroleum benzine, PhMe or gasoline. The wastewater is deflected by the deflector, which has a solvent inlet and retrieving outlet, and is discharged through the top of the apparatus.

[from Chemical Abstracts 89(22):#185527f. 1978]

79D-1425
WASTEWATER TREATMENT
Komiyama, Y., and C. Hidaka. 1978.
Japanese Patent Application 78 97,256

Wastewater treatment, Oil removal, Flocculation, Patent

Pollutant-containing wastewaters are stirred with $Al(OH)_3$ and the resulting coagulated materials are separated and burned to obtain Al_2O_3. The method is applicable to oil removal.

[from Chemical Abstracts 89(22):#185584x. 1978]

79D-1426
TECHNIQUES FOR REMOVING OIL AND GREASE FROM INDUSTRIAL WASTEWATER
Kulowiec, J.J. 1979.
Pollution Engineering 11(2):39-43.

Wastewater treatment, Gravity separation, Flotation, Biological treatment, Sludge, Disposal

Alternative methods are outlined for oily wastewater treatment and removal. Differing concentrations from various industrial sources are given and brief discussions of the following topics are presented: Gravity separation, dissolved air flotation, gas flotation, free-floating oil and emulsions, membrane removal processes, biological treatment, physical-chemical treatment, and disposal of waste oil and sludges.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1427
TREATMENT OF OIL CONTAMINATED WASTE WATERS BY FOAM FRACTIONATION
Mathews, A., P.R. Bishnoi, and W.Y. Svrcek. 1979.
Water Research 13(4):385-391.

Wastewater treatment, Oil removal, Adsorption, Performance testing, *Foam separation

The application of a foam separation process to the removal of organic pollutants from wastewater was studied. The effects of air flow rate, surfactant flow rate, pressure, pH, and solid adsorbent concentration were examined for different feed streams. Foam separation alone achieved 98% removal of emulsified oil from a waste stream. The 3-phase fluidized bed adsorption processes resulted in 98% reduction of organics from two waste waters tested. The results of study establishing the cost feasibility of using a similar process on an industrial scale are presented.

[from Petroleum Abstracts 19(33):#266,510. 1979]

79D-1428
TREATMENT OF PETROLEUM REFINERY, PETROCHEMICAL AND COMBINED INDUSTRIAL-MUNICIPAL WASTEWATERS WITH ACTIVATED CARBON - LITERATURE REVIEW
Matthews, J.E. 1978.
Report EPA/600/2-78/200. 98 p.

Wastewater treatment, Refineries, Petrochemicals, Adsorption, Bibliographies, *Activated carbon

A review is presented of the literature available on activated carbon adsorption treatment for various wastewaters. Over 240 references are cited.

[from Government Reports Announcements 79(5):175.#PB-288 211. 1979]

79D-1429
REMOVAL OF EMULSIFIED OILS FROM EFFLUENTS BY ELECTROCOAGULATION [English summary]
Mejbaum, Z., and J. Stasch. 1978.
Przemysl Chemiczny 57(8):407-410.

Wastewater treatment, Oil removal, Emulsions, *Electrocoagulation

Conditions required for effective oil removal by electrocoagulation are described.

[from Chemical Abstracts 89(26):#220405p. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1430
APPLICABILITY OF ANALYTICAL METHODS FOR DETERMINING PETROLEUM PRODUCTS IN STUDIES ON BIOCHEMICAL SEWAGE PURIFICATION [in Polish]
Miksch, K., 1978.
Nafta 34(6):201-205.

Waste oil treatment, Analytical techniques, Petroleum products, Biodegradation

"A review is given...of the efficiency of sewage biological purification and the biodegradability of petroleum products."

[from Chemical Abstracts 89(24):#203493y. 1978]

79D-1431
MIXED CULTURE OF MYCOTORULA JAPONICA AND PSEUDOMONAS OLEOVORANS ON TWO HYDROCARBONS
Miura, Y., K. Sugiura, M. Yoh, H. Tanaka, et al. 1978.
Journal of Fermentation Technology 56(4):339-344.

Waste oil treatment, Biodegradation, Microorganisms, Hydrocarbons, Models, *Mycotorula, *Pseudomonas

The title culture system was developed on two carbon sources, n-tetradecane and PhOH, as a model for the treatment of petroleum sewage. Characteristics of the system are described.

[from Chemical Abstracts 89(22):#185448f. 1978]

79D-1432
THE OTHER OIL CRISIS: WHAT TO DO WITH "WASTE" OIL
Morris, R. 1978.
Conservation News 43(7):2-5.

Waste oil, Crankcase oil, Disposal, Recycling

This article examines current practices of waste crankcase oil handling and disposal. Currently only about one tenth of this used oil is re-refined for lubrication purposes, and one-third of all the waste oil is unaccounted for, largely dumped into the environment by the do-it-yourselfers who change their own oil.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1433
PURIFYING DRILLING WASTEWATER FROM MECHANICAL IMPURITIES ON A HYDROCLONE INSTALLATION [in Russian]
Mustafaev, A.M., B.M. Gutman, M.A. Karaev, and V.P. Ershov. 1977.
Izvestiya Yysshikh Uchebnykh Zavedenii, Neft i Gaz No. 2, 37-39.

Wastewater treatment, Drilling, Pollution prevention, *Hydrocyclone

Problems involved in the purification of drilling wastewaters to prevent pollution are discussed. The possibility of using hydrocyclones for removal of impurities is studied. "As a result of experiments, a method is worked out and optimum parameters of purification on a hydrocyclone plant with the efficiency of 90-93% by means of recirculation are determined."

[from Energy Research Abstracts 3(4):843.#7997. 1978]

79D-1434
REMOVAL OF SUSPENDED SOLIDS AND OIL FROM WASTEWATER
Nakano, S., and T. Naka. 1979.
Japanese Patent Application 79 30,659

Wastewater treatment, Oil removal, Solid wastes, Filtration, Patent

"Wastewater is filtered with hydrophobic fiber filter, then treated with a composite prepared from polymer fiber and ≤ oxides or hydroxides of Mg, Zn, Pb, Fe, Co, Ni, or Cu to remove suspended solids and oils."

[from Chemical Abstracts 91(4):#26833c. 1979]

79D-1435
OIL-ADSORPTIVE MATERIAL FOR TREATMENT OF WASTEWATERS
Nakano, S., and H. Nakatsui. 1979.
Japanese patent application 79 37,070

Wastewater treatment, Adsorption, Sorbents, Patent

Polyethylene and polypropylene fibers, 3-50 mm long, are dispersed in water, then sheared with a sharp edged device to form fibrillar surfaces for improved adsorption of oil. In a test, emulsified wastewater containing 1000 ppm of heavy oil was reduced to 10 ppm oil content.

[from Chemical Abstracts 91(6):#44182u. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

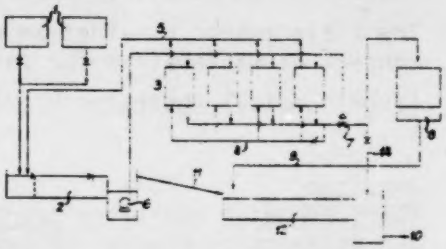
79D-1436
EFFLUENT TREATMENT PROCESS
Oldham, G.F. 1977.
US Patent 4,032,439

Wastewater treatment, Design-engineering, Oil removal, Gravity separation, Filtration, Patent

"A method for treating effluent water containing suspended oil from a gravity separator, comprises passing the effluent through a sand filter so as to remove suspended oil and produce water suitable for effective passage through a biological percolating filter, periodically stopping the flow...and backwashing the sand filter with water to remove suspended oil therefrom."

[from ERDA Energy Research Abstracts 2(22):5601.#53909. 1977]

4,032,439
EFFLUENT TREATMENT PROCESS
Guy Franklin Oldham, London, England, assignor to The British Petroleum Company Limited, London, England
Continuation of Ser. No. 535,181, Dec. 23, 1974, abandoned.
This application Mar. 18, 1976, Ser. No. 668,078
Claims priority, application United Kingdom, Jan. 3, 1974, 00264/74
Int. Cl.² C02C *5/10*
U.S. Cl. 210—17 **6 Claims**



79D-1437
TREATMENT OF EFFLUENT
Oldham, G.F. 1978.
British Patent 1,535,848

Wastewater treatment, Oil removal, Gravity separation, Filtration, Patent

Oily wastewaters are treated by gravity separation to give an oily fraction an aqueous fraction with reduced oil content, and an oily sludge. The oily fraction and sludge are combined, heated, and pressure filtered to retain solids; the aqueous fraction is recycled to the gravity separator for further treatment.

[from Chemical Abstracts 91(6):#44148. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1438
PROCEEDINGS OF THE OPEN FORUM ON MANAGEMENT OF PETROLEUM WASTEWATER (2ND)
Pfeffer, F.M. and F.S. Manning. 1978.
Report EPA/600/2-78-058, Grant EPA-R-804968. 564 p. Final report.

Wastewater treatment, Oil industry, Environmental effects

Summary not available.

[from Government Reports Announcements 78(23):106.#PB-284 247. 1978]

79D-1439
SEPARATION OF SPENT OIL EMULSIONS, OIL-CONTAINING WASHING WATERS AND COOLANTS USING CHEMO-FLOTATION CF. [in German]
Poepel, F., and S. Mangold. 1979.
Umweltschutz-Gesundheitstechnik 13(2):31-32.

Emulsions, Wastewaters, Disposal, Flotation, Oil-water separation

The title method provides an economical way of reducing the hydrocarbon content of wastewaters for permissible disposal.

[from Chemical Abstracts 91(2):#9117e. 1979]

79D-1440
TRACE ORGANICS VARIATION ACROSS THE WASTEWATER SYSTEM OF A CLASS-B REFINERY AND ESTIMATE OF REMOVAL OF REFRACTORY ORGANICS BY ADD-ON MIXED MEDIA FILTRATION AND GRANULAR ACTIVATED CARBON AT PILOT SCALE
Raphaelian, L.A., and W. Harrison. 1978.
Report ANL/WR-78-2, EPA/600/7-78-125. 178 p.

Wastewater treatment, Filtration, Refineries

The efficiency of the title wastewater filtration system that met BPT (best practicable technology) criteria is evaluated. Effluents from the full-scale system and an add-on pilot scale unit were sampled for analysis of common wastewater parameters and trace organic compounds. Common wastewater parameters are also presented for comparison to specific organics concentration data.

[from Government Reports Announcements 78(26):148.#PB-285 596. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1441
PURIFICATION OF CONDENSED WASTEWATER CONTAINING ORGANIC SUBSTANCES
Sano, K., Y. Yamada, and S. Kurihara. 1979.
Japanese Patent Application 79 10,561

Wastewater treatment, Activated sludge, Patent

"The title wastewater is adjusted with seawater to contain >50 mg/L NaCl, then treated with an activated sludge to decompose organic substances." [possibly oil pollution related]

[from Chemical Abstracts 91(4):#26807x. 1979]

79D-1442
OIL-ABSORBING MATERIAL FOR TREATING OIL-CONTAINING WATER
Sato, H., M. Nakatami, and N. Mochida. 1978.
German Patent Application 2,806,851

Wastewater treatment, Oil removal, Adsorption, Patent

An oil-adsorbing material containing an inorganic filler and a cross-linkable polymer is described.

[from Chemical Abstracts 89(26):#220501s. 1978]

79D-1443
DISPOSAL OF WASTE OIL RE-REFINING RESIDUES BY LAND FARMING
Snyder. H.J., Jr., G.B. Rice, and J.J. Skujins. 1976.
Report EPA-600/9-76-015. 15 p.

Waste oil, Disposal, Land farming, Sludge

Factors surrounding the selection and design of sites for the disposal of residues from a waste oil re-refining plant are discussed. The sludge emulsions were spread on a plot and supplemental fertilizer applied. After one year, oil degradation on fertilized lots was ~80%.

[from Chemical Abstracts 88(12):#78544s. 1978]

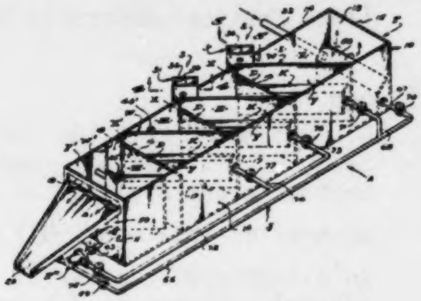
79D-1444
WATER POLISHING MEANS FOR REMOVING OIL AND OTHER FLOTSAM FROM WATER
Stebbins, G.B., and J.F. Stebbins. 1977.
US Patent 4,049,553

Wastewater treatment, Oil removal, Equipment, Design-engineering, Patent

The title apparatus includes an elongate tank, an inlet and a plurality of spaced vertical dams extending transversely across the tank. A vertical weir is provided in each dam zone with its upper portion above the mean fluid level. A pump means and downstream pipes are provided to cause a mixture of fluid, flotsam, and air to be drawn into the open end of the pipe eventually to be dispersed after passing through the apparatus.

[from Energy Research Abstracts 3(4):843.#8004. 1978]

4,049,553
WATER POLISHING MEANS FOR REMOVING OIL AND
OTHER FLOTSAM FROM WATER
George B. Stebbins, 938 Fairbrook Lane, and James F. Stebbins,
2910 Shakespeare Drive, both of San Marino, Calif. 91108
Filed Apr. 12, 1976, Ser. No. 675,733
Int. Cl.^{2} B03D *1/26*
U.S. Cl. 210—195 R **6 Claims**



79D-1445
ORGANIC CONSTITUENTS OF OIL SANDS EXTRACTION PLANT WASTEWATERS
Strosher, M.T., and E. Peake. 1977.
Canadian Institute of Mining and Metallurgy Special Vol. No. 17. p. 749-758.

Wastewaters, Tar sands, Oil discharges, Rivers

The organic constituents of wastewaters from the Athabasca oil sand extraction plant were characterized and quantified on samples taken in 1975. The findings indicate that a daily average of 198 kg (435 lbs) of organic carbon were discharged to the Athabasca river from the tailings pond dike filter system and 1,460 kg (3,245 lbs) from the upgrading plant effluent.

[from Petroleum Abstracts 19(32):#266,227. 1979]

79D-1446
AMINO-DEMULSIFIER FOR OIL-EMULSIFIED WASTEWATER
Suzuki, H., T. Ono, and M. Yamaguchi. 1979.
Japanese Patent Application 79 18,152

Wastewater treatment, Demulsification, Patent

The demulsifier is composed of 0.01-0.5 mole C_{6-60} amino compound per mole metal oxide and/or hydroxide and is "carried on a support."

[from Chemical Abstracts 91(4):#26818b. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1447
REMOVAL OF OIL FROM WASTEWATERS
Takenishi, S., and T. Sato. 1978.
Japanese Patent Application 78 54,176

Oil removal, Wastewater treatment, Patent

Wastewaters containing oils are purified by passing through poly(vinylprylidone)-containing cellulose-fiber fabrics.

[from Chemical Abstracts 89(22):#185525d. 1978]

79D-1448
WASTEWATER MANAGEMENT: A GUIDE TO INFORMATION SOURCES
Tchobanoglous, G. 1976.
Gale Research Company, 1976. 202 p. Man and the Environment Guide Series, Vol. 2.

Wastewaters, Information systems, Manuals

Summary not available.

[from Environmental Management 3(2):163. 1979]

79D-1449
WASTE OIL IN ALASKA. AN EVALUATION OF WASTE OIL GENERAL [sic] AND DISPOSAL, AND RECOMMENDATIONS FOR USE AND CONVERSION. TASK A REPORT: WASTE OIL GENERATION AND DISPOSAL
Thyck, Nyman and Hayes. 1977.
Report PB-287 568. 117 p.

Waste oil treatment, Environmental effects, Disposal, Alaska

Data and an analysis of current waste oil disposal practices are given. Environmental impacts of waste oil, Juneau's waste oil disposal program, and a bibliography of past studies, reports, and documents are presented.

[from Government Reports Announcements 79(3):120.#PB-287 568. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

2. Oil-Water Separation

79D-1450
PROCESSES AND PLANTS FOR BREAKING UP EMULSIONS AND SEPARATING OILS AND GREASES [in German]
Bradke, H.J. 1979.
Metall (Berlin) 33(3):267-272.

Oil-water separation, Emulsions, Regulations

Processes for treatment of oily emulsions are described. Mechanical, physical, chemical, and thermal methods and their combinations are described, and applicable laws and regulations are covered.

[from Chemical Abstracts 91(8):#59778s. 1979]

79D-1451
THE DESIGN APPLICATION OF TILTED PLATE SEPARATOR OIL INTERCEPTORS
Iggleden, G.J. 1978.
Chemistry and Industry, No. 21:826-831.

Oil-water separation, Gravity separation, Wastewater treatment, Design-engineering, Equipment

The design and operating principles of the title apparatus are described "Separation is achieved within gravity differential types of oil-water interceptors by the effect of specific gravity differences between the oil particles and water. The rising velocity of a particle with diameter is governed by Stokes' Law."

[from Petroleum Abstracts 19(27):#264,930. 1979]

79D-1452
POLYURETHANE FOAMS WITH HIGH CAPABILITY OF OIL ABSORPTION
Jarre, W., M. Marx, and R. Wurmb. 1979.
Angewandte Makromolekulare Chemie, Vol. 78:67-74.

Oil-water separation, Absorption, *Sorbent foam

"Ultralight, open-cell polyurethane foams capable of absorbing 100 times their weight of oil from oil-water mixtures were developed by chemical modification of the matrix and adjustment of the foam structure."

[from Chemical Abstracts 91(6):#41622b. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1453
SEPARATION OF OIL FROM WATER [in Japanese]
Mori, M. 1976.
Nisseki Rebyu 18(4):206-212.

Oil-water separation, Equipment, Wastewater treatment

"A review is given with 21 references of various separation methods, including mechanical, physiochemical, electromagnetic and biological."

[from Chemical Abstracts 91(6):#44003m. 1979]

79D-1454
SEPARATION OF WATER AND OILY SUBSTANCES
Ohta, M. 1979.
Japanese Patent Application 79 06,498

Oil-water separation, Filtration, Patent

Filters prepared from cellulose regenerated fibers were used to separate oil and water.

[from Chemical Abstracts 91(2):#6377d. 1979]

79D-1455
METHOD FOR SEPARATING A BINARY LIQUID MIXTURE INTO ITS COMPONENT LIQUIDS
Seo, M. 1978.
British Patent 1,535,606

Oil-water separation, Equipment, Coalescence, Filtration, Patent

Oil-water mixtures are separated by passage through a coiled pipe that contains a number of parallel small-diameter tubes. As the mixture flows laminarly through the coil, oil coalesces on the copper surfaces of the flow passages and moves upward to a collection and filtration area.

[from Chemical Abstracts 91(6):#41252f. 1979]

79D-1456
OIL WATER SEPARATORS (CITATIONS FROM THE NTIS DATA BASE)
Smith, M.F. 1978.
Report NTIS/PS-78/1256. 154 p. Report for 1964-Dec.1978. (Supersedes NTIS/PS-78/1004, NTIS/PS-76/0863, and NTIS/PS-75/710.

Oil-water separation, Equipment, Spill removal, Ballast, Pollution control, Bibliographies

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

Federally sponsored research on the title equipment is cited in 146 abstracts (6 new to previous editions). Operation, testing and performance reports are given for these devices which include centrifuge separators, coalescers, filters, and skimmers. Oil recovery from oil spills and separation from ballast and bilge water are also covered.

[from Government Reports Announcements 79(02):111.#NTIS/PS-78/1256. 1979]

79D-1457
TREATMENT OF WATER CONTAINING OIL
Takahashi, T., and M. Honma. 1979.
Japanese patent application 79 18,840

Oil-water separation, Wastewater treatment, Patent

"Water containing oil is combined with a water soluble N-acylamino acid salt, then with acid, and then separated."

[from Chemical Abstracts 91(6):#44373g. 1979]

79D-1458
WATER-OIL SEPARATOR
Takamatsu, A. 1977.
Japanese Patent 77 42,738

Oil-water separation, Wastewater treatment, Flotation, Patent

A feedwater containing oil is mixed tangentially with a powder and introduced into a powder flotation separator from which the powder is recovered and recycled.

[from Chemical Abstracts 89(22):#185483p. 1978]

79D-1459
OIL/WATER SEPARATION TECHNOLOGY: THE OPTIONS AVAILABLE. PART I.
Tebakin, R.B., R. Trattner, and P.N. Cheremisinoff. 1978.
Water and Sewage Works 125(7):74-77.

Oil-water separation, Wastewater treatment, Equipment, Design-engineering

"A review with 19 references of separation of oil and water in wastes."

[from Chemical Abstracts 89(24):#203469v. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

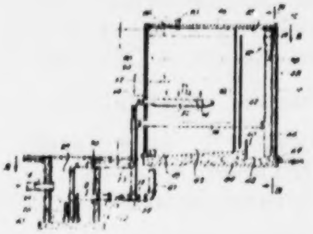
79D-1460
GREASE AND WATER SEPARATING APPARATUS
Walker, H.L., and D.B. David. 1979.
US Patent 4,145,287

Oil-water separation, Wastewater treatment, Equipment, Design-engineering. Patent, *Grease

Wastewater is passed into a separator tank where water and grease are allowed to separate. Means are provided for drawing off the lower water layer. Wastewater is treated in this manner before entering the sewage system.

[from Chemical Abstracts 91(2):#9172u. 1979]

4,145,287
GREASE AND WATER SEPARATING APPARATUS
Harold L. Walker, 1204 E. 95th St., Tacoma, Wash. 98445, and
Don B. David, 33412 28th Pl. SW., Federal Way, Wash. 98003
Filed Jan. 17, 1977, Ser. No. 760,095
Int. Cl.^{2} B01D *21/24*
U.S. Cl. 210—104 **6 Claims**



3. Waste Oil Reclamation and Reuse

79D-1461
STUDY AND DEVELOPMENT OF THE EXTRACTION OF PETROLEUM AND PETROLEUM PRODUCTS FROM GEL ON THE COLUMN VIBRATION EXTRACTOR EKV-50 [in Russian]
Birshtein, I.A. 1978.
Azerbaidzhanskoe Neftyanoe Khozyaistvo, Vol. 7:44-48.

Reuse, Waste oil treatment, Recycling, Equipment, Gasoline, Extraction

Extraction by gasoline of petroleum and petroleum products adsorbed on silica gel after treatment of stratal waters and industrial wastewaters was studied in the title apparatus. The extraction rate was 87-97%.

[from Chemical Abstracts 91(4):#26657y. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1462
METHOD OF REREFINING OIL WITH RECOVERY OF USEFUL ORGANIC ADDITIVES
Forsberg, J.W. 1979.
US Patent 4,028,226

Reuse, Waste oil, Reclamation, Refining, Patent

The waste oil is diluted with a water-soluble polar diluent and insoluble impurities are removed from the resulting solution; water is added to produce a two-phase system, separating the organic phase and recovering the polar diluent therefrom. In this manner it is possible to recover useful oil.

[from ERDA Energy Reserach Abstracts 2(23):5791.#55790. 1977]

79D-1463
METHOD OF REREFINING OIL BY DISTILLATION AND EXTRACTION
Habiby, E.N., and R.W. Jahnke. 1977.
US Patent 4,021,333

Reuse, Lubricating oil, Waste oil, Reclamation, Refining, Patent

Used oil is reclaimed by distillation to remove a volatile fraction, followed by a fraction of lubricating viscosity; the latter is then separated with an immiscible liquid extractant which removes impurities.

[from ERDA Energy Research Abstracts 2(19):4656.#44988. 1977]

79D-1464
USED OIL: COMPARATIVE LEGISLATIVE CONTROLS OF COLLECTING, RECYCLING, AND DISPOSAL
Irwin, W.A. 1978.
Ecology Law Quarterly 6(4):699-754.

Reuse, Reclamation, Recycling, Waste oil, Crankcase oil, Legislation, Europe, US, Government agencies

Legislative and regulatory approaches to oil recycling are described and evaluated, and several European programs for the collection and recycling of used oil under carefully controlled conditions are highlighted. Until recently, federal and state laws in the US have discouraged oil recycling; however, this situation is rapidly changing, as new legislation, such as the FEA-sponsored Model Used Oil Recycling Act and state programs, are proposed.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1465
METHOD FOR RECLAIMING WASTE OIL BY DISTILLATION AND EXTRACTION
O'Blasny, R.H. 1978.
US Patent 4,071,438

Reuse, Waste oil, Refining, Reclamation, Patent

A method for reclaiming or re-refining additive supplemented waste oils is provided. Substantial purification at relatively low cost without creation of disposal problems appears to be the major benefit of the process.

[from Energy Research Abstracts 3(20):#48260. 1978]

79D-1466
SEPARATION OF OILS FROM DEGREASING SOLUTIONS
Ohyagi, T., A. Fukuda, K. Ando, and K. Goto. 1979.
Japanese Patent Application 79 09,450

Reuse, Waste oil treatment, Patent

Degreasing solutions containing 3-200 ml/L oil were mixed with 5-50 g/L builder, heated at 40-90° to separate the oil by salting out, and recycled.

[from Chemical Abstracts 91(4):#22849q. 1979]

79D-1467
LAND AS A WASTE MANAGEMENT ALTERNATIVE [BOOK REVIEW]
Ross, S.S. 1978.
Ann Arbor, Michigan, Ann Arbor Science Publishers, 1978. 811 p.

Reuse, Wastewater treatment, Land farming, Disposal, Pollution prevention, Book review

Reclamation of oil from a rolling mill's wastewater has totalled 600,000 gal in a pre-treatment process from 1972-1976, while some 36 million gal of oily wastes have been sprayed on a 14.6 acre field. Results of this and two dozen other case studies are presented and discussed.

[from Chemical Engineering 85(2):14,16. 1979]

79D-1468
USED OIL RECYCLING KIT
US Department of Energy. 1978.
Report ERDA/02800, ERDA/320321. 46 p.

Reuse, Waste oil, Recycling, Guidelines, Manuals

"Basic facts, ideas, and sample tools necessary to start a communitywide used oil recycling program are provided."

[from Energy Research Abstracts 3(17):#39103. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

4. Legal and Regulatory Aspects

[No entries.]

H. MISCELLANEOUS

79D-1469
OHMSETT ACHIEVEMENTS
Farlow, J.S. 1979.
US Environmental Protection Agency, Office of Research and Development.
20 p. Summary report.

Pollution control, Equipment, Design-engineering, Performance testing, EPA, *OHMSETT facility

This brochure describes the many programs completed through December 1978 and illustrates some of the wide ranging capabilities of the test facility, the operating staff, and the EPA's Oil and Hazardous Materials Spills Branch.

79D-1470
OHMSETT CAPABILITY
Farlow, J.S. 1979.
US Environmental Protection Agency, Office of Research and Development,
20 p. Summary report.

Performance testing, Equipment, Design-engineering, EPA, *OHMSETT facility

The US EPA's Oil and Hazardous Materials Simulated Test Tank (OHMSETT) is the world's largest test facility specifically designed to test the performance of spill control equipment under environmentally safe conditions. This publication summarizes the OHMSETT technical capabilities for performance evaluation of spill control systems and is available from John S. Farlow, Project Officer, US Environmental Protection Agency, Research and Development - IERL-Ci, Edison, NJ 08817.

SECTION II

CURRENT RESEARCH PROJECTS

Title, contract information, and a summary of project objectives are provided in each entry. Sources of project information include: The Smithsonian Science Information Exchange (SSIE); API Environmental Research Annual Status Report; Maritime Research Information Service Abstracts; Scientific and Technical Aerospace Reports; Department of Environment, Canada, Spill Technology Newsletter; Northwest and Alaska Fisheries Center Monthly Report; and written inquiries to organizations and researchers. Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered sequentially with a citation number 79D-R---. Some of the projects listed in previous Oil Pollution Abstracts were recently renewed. These projects are relisted with a current serial number, followed by the original number in parentheses. To locate the original entry, refer to the following list:

Citation Numbers		Dates Covered	Report Number
R-001-74 to R-165-74		July 74 - Oct. 74	EPA-670/2-75-003
R-166-74 to R-244-74		Nov. 74 - Feb. 75	EPA-670/2-75-044
R-245-74 to R-268-74		Feb. 75 - Apr. 75	EPA-670/2-75-059
R-269-74 to R-342-74		May 75 - July 75	EPA-600/2-76-129
R-269-75 to R-304-75		Aug. 75 - Oct. 75	EPA-600/2-76-113
R-001-76 to R-035-76		Nov. 75 - Jan. 76	EPA-600/2-76-185
R-036-76 to R-063-76		Feb. 76 - Apr. 76	EPA-600/2-76-215
R-064-76 to R 123-76		May 76 - July 76	EPA-600/2-76-266
R-124-76 to R-175-76		Aug. 76 - Oct. 76	EPA-600/2-77-037
R-001-77 to R-022-77		Nov. 76 - Jan. 77	EPA-600/2-77-075
R-023-77 to R-039-77		Feb. 77 - Apr. 77	EPA-600/2-77-111
R-040-77 to R-075-77		May 77 - July 77	EPA-600/2-77-243
R-076-77 to R-096-77		Aug. 77 - Oct. 77	EPA-600/2-78-005
R-001-78 to R-020-78	5(1)	Nov. 77 - Jan. 78	EPA-600/2-78-071
R-021-78 to R-057-78	5(2)	Feb. 78 - May 78	EPA-600/7-78-160
R-058-78 to R-150-78	5(3)	Jun. 78 - Sep. 78	EPA-600/7-78-218
R-151-78 to R-200-78	5(4)	Oct. 78 - Dec. 78	EPA-600/7-79-040
79A-R001 to 79A-R009	6(1)	Jan. 79 - Mar. 79	EPA-600/7-79-160
79B-R010 to 79B-R069	6(2)	Apr. 79 - June 79	EPA-600/________
79C-R070 to 79C-R085	6(3)	July 79 - Sep. 79	EPA-600/________

CURRENT RESEARCH PROJECTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. Detection and Monitoring

79D-R086 (R-057-77)

DETECTION AND CARCINOGENICITY OF OILS IN SEA WATER - USE OF HYBRID FISH AND FOOD CHAINS

Principal Investigator: Humm, D.G.
Performing Organization: University of North Carolina, Dept. of Zoology, Chapel Hill, NC 27514
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561
Period: 8/76 - 8/79
Funds: $1,500 FY 79

Carcinogens, Bioindicators, Detection, Fish

Hybrid fish with a high incidence of neoplasia are being used to develop genetically modified fish to serve as quick-screen indicators of carcinogens.

Status: Preliminary results indicate that such crosses are possible and may have validity as a quick-screen tool.

[from SSIE No. GMA-5603]

79D-R087

SPECIFICATIONS FOR AUTOMATIC SAMPLING AND MONITORING INSTRUMENTATION TO ENFORCE STANDARDS FOR EFFLUENTS AND DRINKING WATER

Principal Investigators: Mentink, A.F., R.H. O'Herron, P.C. Lin, J.P. Donnelly, and W.J. Averett
Performing Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., 26 W St. Clair St., Cincinnati, OH 45268
Supporting Organization: Same
Period: 7/61 - 9/79
Funds: $273,000 FY 79

Wastewaters, Monitoring, Sampling, Equipment, Detection, Water quality

Field instruments will be provided for automatic collection and measurement of pollution parameters such as oil in water, organic carbon, chlorine, sample pretreatment, suspended solids, data handling systems, and other discharge parameters of municipal and industrial effluents.

Status: Manufacturers equipment designs have been improved upon based on a series of EMSL-CI reports.

[from SSIE No. ZMA-1534-1]

79D-R088
DEVELOPMENT OF OIL-IN-WATER MONITOR
Principal Investigator: Silvus, H.S.
Performing Organization: Southwest Research Institute, 8500 Culebra Rd., San Antonio, TX 78228
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., 26 W. St. Clair St., Cincinnati, OH 45268
Period: 5/78 - 5/80
Funds: $59,990 FY 78

Monitoring, Equipment, Wastewaters, Oil industry, Chromatography

An oil-in-water monitoring device is to be developed which will provide monitoring of wastewaters from petroleum refineries, shale oil extraction plants and coal liquefaction. The device will make use of reverse phase liquid chromatography, optical fiber technology and a suitable optical sensor, and will monitor 75 ppm or greater of oil in water. A prototype instrument will be designed, fabricated and tested.

Status: The concept has been demonstrated as feasible, as reported at a symposium in March 1978.

[from SSIE No. GMA-5089-1]

2. Sampling and Analysis

79D-R089
OIL POLLUTION CONTROL AT MILITARY INSTALLATIONS
Principal Investigator: Fileccia, R.J.
Performing Organization: US Dept. of Defense, Army, Corps of Engineers, Construction Engineering Research Lab., PO Box 4005, Champaign, IL 61820
Supporting Organization: Same
Period: 10/77 - 9/81
Funds: NA

Chemical analysis, Oil discharges, Wastewaters, Analytical techniques, Pollution control

Several Class I installations will be surveyed to determine the causes, magnitude and nature of oily waste discharges from facility operations. Methods for determining pollutants in water will be evaluated. The results will be used in the preparation of an engineer technical letter for distribution to the field.

[from SSIE No. ZQA-198126-2]

79D-R090

TECHNICAL SERVICES TO SUPPORT THE QUALITY ASSURANCE PROGRAM

Principal Investigator:	Kowalski, V.
Performing Organization:	Bionetics Inc., PO Box 19070, Cincinnati, OH 45219
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., 26 W. St. Clair St., Cincinnati, OH 45268
Period:	1/77 - 9/79
Funds:	$176,200 FY 79

Water quality, Chemical analysis, Equipment, EPA, Sampling

The primary objective of the title experiment is to provide the Quality Assurance Branch, EMSL-Cincinnati with technical support services.

Status: Quality control samples were developed for oil and grease, turbidity, nonfilterable residue, and volatile residue samples. The sampling and sample preservation manual was revised and 20,000 quality control samples were distributed.

[from SSIE No. GMA 4948-1]

79D-R091

OIL SPILL RESPONSE RESEARCH, NORTH ATLANTIC COAST (NORFOLK, VIRGINIA TO EASTPORT, MAINE)

Principal Investigator:	Payne, R.R.
Performing Organization:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., S. Ferry Rd., Narragansett, RI 02882
Supporting Organization:	Same
Period:	5/79 - 9/81
Funds:	$75,000 FY 79

Sampling, Oil spills, Coasts, Habitats, Benthos, Marine organisms, Spill response, Statistical analysis

Response research will include sampling and measuring regimes for different coastal habitats, evaluation of short- and long-term effects of spilled oil on selected organisms, ecological studies on benthic organisms, sampling and analysis of petroleum in the water column, sediments, and pelagic and benthic organisms and statistical analysis of sampling and measuring methods.

[from SSIE No. ZMA-1501-1]

79D-R092
CAPILLARY COLUMNS IN GC/MS ANALYSIS
Principal Investigator: Shackelford, W.M.
Performing Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., College Station Rd., Athens, GA 30605
Supporting Organization: Same
Period: 7/75 - 7/81
Funds: $16,100 FY 79

Chemical analysis, Oil spills, GC/MS, Equipment

Techniques for utilizing capillary columns in GC/MS systems are being developed and evaluated for their effects on the versatility and sensitivity of the system. Existing low resolution chemical ionization (CI) mass spectrometry equipment will be modified to permit mixing CI reagent gases with GC column effluent, and the feasibility of using various gases and gas mixtures, including oxidizing reagent gases, will be determined.

Status: Two low resolutions EI/CI systems have been adapted for glass capillary columns. Excellent resolution was demonstrated for oil spill hydrocarbons; poorer resolution was experienced with polar materials.

[from SSIE No. ZMA-987-2]

79D-R093
EVALUATION OF THE STABILITY CHARACTERISTICS OF OILY WATER EMULSIONS
Principal Investigator: Tuffly, B.
Performing Organization: Rockwell International Corp., Rocketdyne Division, 8900 DeSoto Ave., Canoga Park, CA 91304
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., 5555 Ridge Ave., Cincinnati, OH 45268
Period: 9/77 - 6/79
Funds: $80,000 FY 78

Chemical analysis, Sampling, Emulsions, Wastewater treatment, Ballast, Oil tanks

The objective of this research is to characterize the influent and effluent from each processing unit within an oil tank ballast-water treatment plant. This will be accomplished by a program of sampling and chemical analysis within the plant.

Status: Nearly half of the hydrocarbons discharged from the plant have been found to be benzene, toluene or xylene, compounds that were completely missed by the method of analysis specified by the plant's discharge permit.

[from SSIE No. GMA-4993-1]

3. Source Identification

79D-R094
HIGH-RESOLUTION SEPARATION OF ORGANICS IN WATER

Principal Investigator:	Bertsch, W.
Performing Organization:	University of Alabama, Department of Chemistry, University, AL 35486
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., College Station Rd., Athens, GA 30605
Period:	9/76 - 2/79
Funds:	$47,000 FY 78

Source identification, Crude oil, Petroleum products, Detection, Chemical analysis, Sediments, Chromatography, *Fingerprinting

Organics in water and sediment will be analyzed with emphasis on development of fingerprinting techniques for crude oil and petroleum products. High resolution gas chromatography will be used to distinguish indigenous from introduced hydrocarbons.

Status: A two-dimensional GC unit has been successfully tested and a computer program has been applied to the comparison and matching of chromatographic patterns from oil spill samples with those from suspect samples. The project has been terminated.

[from SSIE No. GMA-3451-2]

B. OIL POLLUTION AND PREVENTION AND CONTROL

1. Cleanup and Removal

79D-R095
HYDRODYNAMIC CHARACTERISTICS OF BOOMS - PHASE II
Principal Investigator: Ackerman, R.
Performing Organization: Mason & Hanger Silas Mason Co., Inc., PO Box 156, Leonardo, NJ 07737
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., 5555 Ridge Ave., Cincinnati, OH 45268
Period: 5/77 - 12/78
Funds: $23,000 FY 78

Spill cleanup, Booms, Equipment, Design-engineering, *OHMSETT facility

The objective of the project was to determine the effects of boom angle, length and rigging configuration on the successful diversion of oil spilled on inland waters by experimentation with full-size equipment and oil of known characteristics at EPA's OHMSETT facility.

Reports and Publications

BOOM CONFIGURATION TESTS FOR CALM WATER, MEDIUM CURRENT SPILL DIVERSION
Breslin, M.K. 1979.
Report EPA-600/2-78-186. 49 p.

[from SSIE No. GMA-4987-1]

2. Legal and Regulatory Aspects

79D-R096
POLLUTION CONTROL GUIDANCE FOR OIL SHALE DEVELOPMENT
Principal Investigator: Cruse, H.
Performing Organization: Jacobs Engineering Co., 837 S. Fair Oaks Ave., Pasadena, CA 91105
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., 5555 Ridge Ave., Cincinnati, OH 45268
Period: 6/78 - 12/79
Funds: $121,000 FY 79

Oil shale, Development, EPA, Regulations, Pollution prevention, Guidelines

CURRENT RESEARCH PROJECTS

The environmental problems of oil shale development will be discussed and concerns and interest of EPA identified. Interim EPA emission effluent and solid waste standards will be suggested.

Status: The initial draft report has been submitted for review.

[from SSIE No. GMA-5687]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

1. Biological Aspects

79D-R097 (79B-R031)
EFFECTS OF DRILLING FLUIDS AND OIL IN CORALS OCCUPYING HARD-BANK COMMUNITIES

Principal Investigator:	Bright, T.J.
Performing Organization:	Texas A&M Research Foundation, Faculty Exchange Box H, College Station, TX 77843
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32516. Grant R-805441
Period:	7/77 - 6/79
Funds:	$1,500 FY 79

Drilling, Coral reefs, Toxicity, *Drilling muds

The effect of drilling muds and their components on corals will be determined by exposing the corals to the contaminants in flow through aquaria on a platform 12 mi offshore of Panama City.

Status: Preliminary acute toxicity tests have been completed.

[from SSIE No. GMA-5499-1]

79D-R098
SENSORY AND BEHAVIORAL EFFECTS OF POLLUTANTS ON THE CRAB AND LOBSTER FISHERY

Principal Investigator:	Case, J.F.
Performing Organization:	University of California, Santa Barbara, Marine Science Institute, Santa Barbara, CA 93106
Supporting Organization:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, DC 20235
Period:	00/78 - 00/80
Funds:	$21,054 FY 78

Hydrocarbons, Biological effects, Behavior, Natural seepage, Crustaceans

The objectives of the project include assessment of the sensory and behavioral effects of oil seeps and other petroleum sources on orientation to traps, examination of the efficiency of natural and artificial baits in normal and contaminated environments, and determination of sensory and behavioral adaptation of crabs and lobsters to long-term exposure to petroleum.

[from SSIE No. GBP-3823]

79D-R099

EFFECTS OF PETROLEUM COMPOUNDS ON ESTUARINE FISHES

Principal Investigator: Martin, B.J.
Performing Organization: University of Southern Mississippi, Dept. of Biology, Hattiesburg, MS 39401
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561
Period: 6/76 - 10/78
Funds: $60,000 FY 78

Carcinogens, Biological effects, Fish

Carcinogenic effects of benzo[a]pyrene and 3-methylcholanthese were assayed in freshwater and saltwater fish. Other pathobiological tools were also utilized to determine the effects of carcinogens on fish.

Status: A final report is in preparation.

[from SSIE No. GMA-3065-3]

79D-R100

MEMBRANE TOXICITY THEORY AND ENVIRONMENTAL POLLUTANTS

Principal Investigators: Miller, D.S., D.B. Peakall, and R.G. Butler
Performing Organization: Mount Desert Island Biological Lab., Old Bar Harbor Road, Salisbury Cove, ME 04672
Supporting Organization: US Dept. of Health, Education and Welfare, Public Health Service, National Institute of Environmental Health Sciences, PO Box 12233, Research Triangle Park, NC 27709
Period: 6/77 - 5/80
Funds: $62,994 FY 79

Biological effects, Toxicity, Birds, Fish, Behavior

The immediate objective of this study is a comprehensive evaluation of the effects of heavy metal, petroleum, and organochlorine pollutants on osmoregulatory and nutritive membrane functions in selected species of aquatic birds and fish. Current work is focused on petroleum and its effects on the physiology and behavior of marine birds and fish.

[from SSIE No. IES-920-7]

79D-R101 (R-014-77)

EFFECTS OF COMPOUNDS PRODUCED FROM PETROLEUM UTILIZATION ON SELECTED MARINE INVERTEBRATES WITH PARTICULAR REFERENCE TO CARCINOGENESIS

Principal Investigator:	Mix, M.C.
Performing Organization:	Oregon State University, Dept. of General Science, Corvallis, OR 97331
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561
Period:	6/76 - NA
Funds:	$20,000 FY 78

PAH, Carcinogens, Invertebrates, Mollusks, Uptake, Sources, Oregon

Objectives of this project are the following: To determine the concentration (body burdens) of selected environmental chemical carcinogens in economically important mollusks and crustaceans from Oregon waters; to determine if there is a potential public health hazard to man from consuming shellfish which contain petroleum by-products that are carcinogenic; to survey populations of bivalve mollusks, determine the incidence of neoplastic diseases, and ascertain if there is any correlation between carcinogen concentrations and incidence of disease; to identify point sources of carcinogens present in Oregon bays and estuaries used in this study; and to determine rates of PAH uptake and release in bivalve mollusks.

Status: The final report is in preparation.

[from SSIE No. GMA-5506-1]

79D-R102

ASSESSMENT OF THE EFFECTS OF BOTTOM DISTURBANCE ON THE ENVIRONMENT OF A CLEAR SUBARCTIC STREAM

Principal Investigators:	Morrow, J.E., and R.L. Smith
Performing Organization:	University of Alaska, School of Environmental Sciences, Fairbanks, AK 99701
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., 200 SW 35th St., Corvallis, OR 97330
Period:	7/75 - 6/79
Funds:	$27,884 FY 78

Crude oil, WSF, Sublethal effects, Fish, Rivers, Subarctic regions, *Juvenile chum-salmon

The effects of sublethal exposure to the WSF of crude oil on the condition and gut morphology of the juvenile chum-salmon will be studied. The morphology and structural integrity of the gut will be examined for potential abnormalities associated with the swallowing of oil-contaminated seawater.

[from SSIE No. GMA-2447-4]

79D-R103
TOXIC, SUBLETHAL AND LATENT EFFECTS OF SELECTED PETROLEUM HYDROCARBONS AND BARIUM SULFATE ON MARINE ORGANISMS

Principal Investigator:	Rao, K.R.
Performing Organization:	University of West Florida, Dept. of Biology, Pensacola, FL 32504
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561
Period:	5/76 - 5/79
Funds:	$47,000 FY 78

PAH, Hydrocarbons, Uptake, Toxicity, Sublethal effects, Growth, Invertebrates, *Bioaccumulation

The toxic, sublethal and latent effects of PAHs and barium sulfate on larvae and adult stages of selected invertebrates are being examined.

Status: Methods for detecting developmental effects of xenobiotics have been developed and bioaccumulation of xenobiotics used in offshore oil and gas exploration has been established.

[from SSIE No. GMA-2794-3]

79D-R104 (R-046-78)
GENETIC VARIATION AND RESISTANCE TO CARCINOGENS IN NATURAL WATERS

Principal Investigator:	Schultz, R.J.
Performing Organization:	University of Connecticut, Graduate School, Biological Sciences Group, Storrs, CT 06268
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561
Period:	6/77 - 6/80
Funds:	$1,500 FY 79

Carcinogens, Fish, Bioassay, Toxicity, Oil shale, Petroleum products

The feasibility of using isogenic fish to detect carcinogens will be evaluated. The validated bioassay system will be used to test the carcinogenic properties of compounds from petroleum and shale oil.

[from SSIE No. GMA-5602]

79D-R105

EFFECTS OF OIL ON THE GROWTH AND ENERGY UTILIZATION OF JUVENILE PINK SALMON

Principal Investigator:	Shaw, D.G.
Performing Organization:	University of Alaska, Institute of Marine Sciences, Fairbanks, AK 99701
Supporting Organization:	US Department of Commerce, NOAA, Sea Grant Office, Washington, DC 20235
Period:	1978 - 10/80
Funds:	$23,594 FY 78

Biological effects, Contamination, Growth, Metabolism, Fish, *Juvenile pink salmon

In the title study oil-contaminated food will be used to determine its effect on the growth efficiency of young salmon. Exogenous factors will be held constant except for the presence of oil in the food of the test fish. Growth will be determined as a change in weight and length over time, and these two parameters will be correlated to each other. The study will help to predict the viability of pink salmon should they be exposed to oil contamination.

[from SSIE No. GBP-4107]

79D-R106 (79A-R001)

EFFECTS OF OIL ON REPRODUCTIVE STAGES OF MARINE MACROALGAE

Principal Investigators:	Steele, R.L, and C. Belin
Performing Organization:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., S. Ferry Rd., Narragansett, RI 02882
Supporting Organization:	Same
Period:	6/76 - 12/80
Funds:	$60,000 FY 79

Crude oil, Fuel oil, Algae, Toxicity, Reproduction, Water quality

The effects of various oils on reproduction of marine algae will be determined. The data will be used in determining water quality criteria.

Status: 2 ppb of No. 2 fuel oil, JP-4, JP-5, or Willimar crude oil prevented fertilization of *Fucus edentatus* apparently because of toxic effects on sperm viability. *Laminaria saccharina* spores did not germinate at oil concentrations above 20 ppb.

[from SSIE No. ZMA-1184-2]

Reports and Publications

SENSITIVITY OF SOME BROWN ALGAL REPRODUCTIVE STAGES TO OIL POLLUTION
Steele, R.L. 1977.
Journal of Phycology 13(Supplement):64. Abstract.

79D-R107 (R-178-78)
EFFECTS OF HYDROCARBONS ON DEFENSE MECHANISMS
Principal Investigators: Tripp, M.R., and C.R. Fries
Performing Organization: University of Delaware, Dept. of Biological Sciences, Newark, DE 19711
Supporting Organization: US Dept. of Health, Education & Welfare, Public Health Service, National Institute of Environmental Health Sciences, PO Box 12233, Research Triangle Park, NC 27709
Period: 4/77 - 3/80
Funds: $28,195 FY 79

Hydrocarbons, Biological effects, Fish, Mollusks, *Immune system

"An assay for fish lymphocytes that form rosettes with sheep red blood cells has been developed and used to measure the immune capabilities of normal and stressed animals....Studies will continue to determine the effects of hydrocarbon stress on tissues, cells, and hemolymph of clams."

[from SSIE No. 1ES-1531-3]

2. Physical and Chemical Aspects

79D-R108
CHEMISTRY OF AQUATIC ORGANIC MATTER
Principal Investigator: Goerlitz, D.F.
Performing Organization: US Geological Survey, Water Resources Division, 345 Middlefield Rd., Menlo Park, CA 94025
Supporting Organization: Same
Period: 7/75 - 10/78
Funds: $60,036 FY 78

WSF, Physical effects, Chemical effects, Groundwater, Contamination, Chromatography

The title study will be investigating the physical-chemical interactions of relatively stable, water soluble organic compounds of natural and manmade origin when introduced into a groundwater system.

Status: Sorption studies using pentachlorophenol and aquifer material from the study site were completed. Two field techniques using high-pressure liquid chromatography were developed and tested.

[from SSIE No. ZUA-4131-2]

3. Baseline and Environmental Impact Studies

79D-R109 (R-188-78)
ENVIRONMENTAL ASSESSMENT OF THE NORTH ATLANTIC OUTER CONTINENTAL SHELF (GEORGES BANK)

Principal Investigator:	Aaron, J.M.
Performing Organization:	US Geological Survey, Geologic Division, Woods Hole, MA 02543
Supporting Organization:	US Geological Survey, Geologic Division, 12201 Sunrise Valley Dr., Reston, VA 22092
Period:	10/77 - NA
Funds:	$272,100 FY 79

Offshore, Exploration, OCS, Environmental effects, Georges Bank, Baseline studies, Risk analysis

The end product of this project will be the documentation of the major stresses and potential hazards that may be encountered in petroleum exploration and development on Georges Bank. Sediment mobility and sea floor stability will be assessed; the composition, flux and direction of suspended matter transiting the Bank will be estimated; and new current meter, meteorological, and other oceanographic data will be gathered. The result will be "a better three-dimensional picture of the hydrography of the Bank, which is critical in determining trajectories of oil spills and other pollutants."

[from SSIE No. ZUA-4175-2]

79D-R110 (R-190-78)
ENVIRONMENTAL ORGANIC GEOCHEMISTRY OF OUTER CONTINENTAL SHELVES AND NEARSHORE ENVIRONMENT

Principal Investigator:	Miller, R.E.
Performing Organization:	US Geological Survey, Geologic Division, 12201 Sunrise Valley Dr., Reston, VA 22092
Supporting Organization:	Same
Period:	10/77 - NA
Funds:	$237,400 FY 79

Baseline studies, OCS, Hydrocarbons, Sediments, Atlantic Coast, Gulf of Mexico, *Geochemistry

The principal objectives of this project are to determine quantitatively and distinguish qualitatively the low-level baseline concentrations of natural organic constituents such as hydrocarbons, asphaltics, fatty acids, sterols, and metallo-organic complexes in shelf and slope sediments, and to differentiate and classify those same substances that are related to specific geological and geochemical processes. The study area for this project encompasses the eastern seaboard Atlantic states and the Gulf of Mexico seaboard states.

[from SSIE No. ZUA-3570-4]

4. General Aspects

79D-R111

OIL SPILL EXPERIMENT

Principal Investigator:	Menzel, D.W.
Performing Organization:	Skidaway Institute of Oceanography, PO Box 13687, Savannah, GA 31406
Supporting Organization:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, DC, 20235
Period:	9/76 - 12/79
Funds:	$63,200 FY 78

Oil spills, Marshes, Hydrocarbons, Environmental effects, Biodegradation, Predictions

In order to better predict impacts of oil spills on coastal marshes, the title experiment will determine water and sediment load exchanges, determine degradation rates of hydrocarbon components in water and marsh sediment, and determine hydrocarbon effects on marsh flora and fauna.

[from SSIE No. GBP-3077-1]

D. FATE OF OIL IN THE ENVIRONMENT

1. General Fate of Oil

79D-R112
PELAGIC AND BEACH TAR POLLUTION IN KUWAIT

Principal Investigators:	Anderlini, V., and L. Al-harmi
Performing Organization:	Kuwait Institute for Scientific Research, PO Box (24885) Safat, Kuwait
Supporting Organization:	Same, Contract E&ES 11A
Period:	(2 yr)
Funds:	5,000 K.D.

Tar, Beaches, Source identification, Fate

Objectives of the project are to determine the extent of pelagic and beach tar pollution in Kuwait, estimate the residence time of tar on beaches and the total tar crop, and identify the sources of tar pollution.

Status: A preliminary investigation of tar pollution along the coast of Kuwait has been completed.

Reports and Publications

OIL SPILLS AND TAR POLLUTION ALONG THE COAST OF KUWAIT
Oostdam, B.L., and V. Anderlini. 1978.
Safat, Kuwait, Kuwait Institute of Scientific Research, 1978. 54 p.

Information source: V. Anderlini, address above.

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT AND PRODUCTION

1. Biological Aspects

79D-R113
AN ECOLOGICAL STUDY OF THE TERMINOS LAGOON (CAMPECHE, MEXICO) WITH SPECIAL REFERENCE TO FISHERIES RESOURCES AND THE POTENTIAL IMPACT OF MAN
Principal Investigator: Day, J.W.
Performing Organization: Louisiana State University, Dept. of Marine Science, Center for Wetlands Resources, University Station, Baton Rouge, LA 70803
Supporting Organization: US National Science Foundation, Division of International Programs, 1800 G St. NW, Washington, DC 20550
Period: 3/79 - 8/80
Funds: $11,740 FY 79

Development, Environmental effects, Marine environment, Fisheries, Mexico, *Terminos Lagoon

This study will develop an environmental framework for documenting the functioning and value of natural resources of the Terminos Lagoon and predict changes which may occur due to the activities of man. Tasks include analysis of the lagoon's role in fisheries, implementation of a hydrodynamic-ecological model of the lagoon, and analysis of ecological and economic connections in the Terminos region.

[from SSIE No. GSN-3330]

2. General Aspects

79D-R114
ENVIRONMENTAL EFFECTS OF OFFSHORE DRILLING AND OIL ON THE MARINE ENVIRONMENT
Principal Investigator: Schuh, N.
Performing Organization: US Dept. of Defense, Navy, Naval Coastal Systems Lab., Panama City, FL 32407
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561
Period: 4/77 - 12/79
Funds: $1,500 FY 79

Development, Environmental effects, Oil shale, Drilling, Marine environment, Platforms

An offshore platform in Panama City will be used to determine the environmental effects on the marine environment of offshore oil extraction in general, and specifically, of shale oil-derived bunker C fuel.

[from SSIE No. ZMA-1158-1]

79D-R115
EFFECTS OF DRILLING MUD CONSTITUENTS ON THE SEDIMENTARY MICROFLORA AND THE BASE OF THE MARINE BENTHIC FOOD WEB
Principal Investigator: White, D.C.
Performing Organization: Florida State University, Dept. of Biological Sciences, 205 Wildwood Dr., Tallahassee, FL 32306
Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561
Period: 8/78 - 8/80
Funds: $1,500 FY 79

Environmental effects, Offshore, Drilling, Benthos, Marine organisms, Food web, *Drilling muds

The objective of the title project is to develop and apply methods for assessing environmental effects of offshore oil and gas development on marine organisms. The approach used will be to determine effects resulting from exposure of marine organisms.

[from SSIE No. GMA-5601]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER AND STORAGE

[No entries.]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

1. Waste Treatment and Disposal Methods

79D-R116

TREATMENT OF OIL REFINERY WASTEWATERS FOR REUSE USING A SAND FILTER-ACTIVATED CARBON SYSTEM

Principal Investigator:	Bubri, L.
Performing Organization:	B.P. Oil Corp., PO Box 428, Marcus Hook, PA 19061
Supporting Organization:	US Environmental Protection Agency, Office of Research & Development, Robert S. Kerr Environmental Research Lab., PO Box 1198, Ada, OK 74820
Period:	7/71 - 7/79
Funds:	NA

Wastewater treatment, Refineries, Filtration, Reuse

A refinery wastewater treatment facility was built consisting of sand filtration and activated carbon adsorption. Two-stage centrifugation was used for sludge dewatering and oil recovery, and investigation carried out of the reuse of treated effluent for cooling tower and boiler feed water makeup.

Status: A final report has been submitted; it addresses treatability, filtration, activated carbon, residual centrifugation, and economics.

[from SSIE No. GMA-5208-1]

79D-R117

EVALUATE PETROLEUM EFFLUENT DISCHARGES FOR IMPACTS ON THE WEST COAST AND/OR ESTUARINE ECOSYSTEMS

Principal Investigator:	Randall, R.C., D.T. Specht, and R.M. Brice
Performing Organization:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., Marine Div., 200 SW 35th St., Corvallis, OR 97330
Supporting Organization:	Same
Period:	10/76 - 9/82
Funds:	$120,000 FY 79

Wastewaters, Estuaries, Ecosystems, Toxicity, Sublethal effects, Bioassay, *Staghorn sculpin

Assay techniques will be developed for response indications of lethal and sublethal stress effects of petroleum processing waste discharges. A "chem screen" approach will be used to determine stress effects in selected staghorn sculpin tissue.

Status: A procedure for stress detection in sculpin tissue has been developed,and analytical techniques have been determined for the chem screen protocol. "The marine algal assay procedure and "Ecologen" have been evaluated to the point where toxicity data may now be collected."

[from SSIE No. ZMA-1558-1]

2. Oil-Water Separation

79D-R118

FEASIBILITY STUDY OF OIL/WATER SEPARATION TECHNIQUES FOR APPLICATION TO RECOVERED OIL/WATER

Principal Investigator:	Unknown
Performing Organization:	US Department of Defense, Navy, David W. Taylor Naval Ship Research & Development Center, Bethesda, MD 20084
Supporting Organization:	US Coast Guard, 400 7th St. SW, Washington, DC 20590
Period:	9/78 - 11/79
Funds:	$96,000 FY 79

Oil-water separation, Spill cleanup, Storage, Equipment, USCG

A feasibility study will be conducted on oil/water separation techniques for application to recovered oil/water. Temporary storage of recovered fluid during spill cleanup operation has become a major problem for the USCG. To alleviate the problem, Coast Guard formulated a requirement for a recovery device oil/water separator for increasing the oil content of the recovered fluid.

[from SSIE No. DC-162119]

Guide to the Master List of Keywords and the Subject Keyword Index

The following Master List of Keywords is a controlled list of approximately 400 scientific, technical, geographic, and other descriptive terms relevant to the field of oil pollution. For each literature abstract and research project summary contained in this issue, a string of several terms has been selected from this list to serve as a reference guide to each entry. The Master List is continually updated to reflect common word usage and current trends in oil pollution literature and research. When necessary, additional free-language terms are assigned to more thoroughly define the subject coverage of an entry; such terms are preceded by an asterisk (*).

The terms included in the Master List are alphabetically permuted by computer to form the Subject Keyword Index. Thus, the string of keywords for each abstract is listed in all possible alphabetical arrangements to provide rapid access to, and cross-referencing of, any entry in this issue. The free-language terms (*) are not alphabetically permuted.

To effectively use the permuted Subject Keyword Index, the reader should use the following procedure: 1) Scan the Master List of Keywords and Cross-Reference Guide to determine all possible terms and word variants applicable to the topic of interest; 2) look up all terms in the permuted Subject Keyword Index and scan the other keywords in each entry to determine the relevancy of the entry; 3) note the citation numbers of relevant entries and locate them in the body of the ABSTRACTS. Citation numbers prefixed with the letter R denote research project summaries.

MASTER LIST OF KEYWORDS AND CROSS-REFERENCE GUIDE TO RELATED TERMS

S: See
SA: See also

- Absorption
  - SA: Adsorption, Sorbents
- Activated sludge
  - SA: Biological treatment, Sludge, Solid wastes
- Acute effects
  - SA: Biological effects, Mortality, Toxicity
- Adsorption
  - SA: Absorption, Sorbents
- Africa
- Air-Sea interface
  - S: Sea surface
- Alabama
- Alaska
  - SA: Gulf of Alaska
- Algae
  - SA: Phytoplankton
- Amoco Cadiz spill
  - SA: France
- Analytical techniques
  - SA: Bioassay, Chemical analysis, Chromatography, Concentrations, Detection, GC/MS, Source identification, Spectrometry, Spectroscopy
- Animals
  - SA: Birds, Invertebrates, Marine mammals, Marine organisms, Vertebrates, Wildlife
- Annelids
  - SA: Invertebrates, Marine organisms, Polychaetes
- Antarctica
- API (American Petroleum Institute)
- Aquatic environment
  - SA: Freshwater, Lakes, Marine environment, Rivers, Sea surface
- Arctic
  - SA: Ice, Subarctic regions
- Arctic Ocean
- Argentina
- Argo Merchant spill
- Aromatic hydrocarbons
  - SA: Hydrocarbons, PAH
- Atlantic coast
- Atlantic Ocean
- Australia
- Bacteria
  - SA: Microorganisms
- Bahamas
- Ballast
- Baltic Sea
  - SA: Segregated ballast, Tankers, Wastewater treatment
- Barents Sea
- Baseline studies
  - SA: EIS
- Bays
  - SA: Coastal waters, Estuaries, Harbors
- Beach cleanup
  - SA: Spill cleanup
- Beaches
  - SA: Coasts, Intertidal zone, Sediments, Shorelines
- Beaufort Sea
- Behavior
  - SA: (Physical) Dispersion, Drift, Fate, Models, Movement, Predictions, Simulations, Spreading
  - SA: (Biological) Bioassay, Biological effects, Development, Growth, Toxicity
- Benthos
  - SA: Invertebrates, Marine organisms
- Bering Sea
- Bermuda
- Bibliographies
- Bilges
  - S: Ballast, Ships, Tankers
- Bioassay
  - SA: Analytical techniques
- Biodegradation
  - SA: Bacteria, Microorganisms

- Biogenic hydrocarbons
  - SA: Hydrocarbons
- Bioindicators
  - SA: Detection
- Biological effects
  - SA: Acute effects, Chronic effects, Sublethal effects, Toxicity
- Biological treatment
  - SA: Wastewater treatment
- Biomass
- Birds
  - SA: Animals, Vertebrates, Wildlife
- Black Sea
  - SA: USSR
- BLM (Bureau of Land Management)
  - SA: Government agencies, US government
- Blowout prevention
- Blowouts
- Book review
- Booms
  - SA: Design-engineering, Equipment, Spill containment
- Bouchard 65 spill
  - SA: Buzzards Bay
- Brazil
- Burning
  - SA: Incineration
- Buzzards Bay
  - SA: Massachusetts
- California
  - SA: Pacific coast
- Canada
- Carcinogens
  - SA: Health hazards, Mutagens, PAH
- Caribbean Sea
- Caspian Sea
  - SA: USSR
- Chemical analysis
  - SA: Analytical techniques, Chromatography, Detection, GC/MS, Source identification, Spectrometry, Spectroscopy
- Chemical effects
- Chesapeake Bay
  - SA: Delaware, Maryland
- Chile
- China
- Chromatography
  - SA: Analytical techniques, Chemical analysis, GC/MS
- Chronic effects
  - SA: Biological effects, Toxicity
- Coalescence
  - SA: Flocculation, Wastewater treatment
- Coastal waters
  - SA: Atlantic coast, Bays, Coasts, Harbors, Pacific coast
- Coastal zone management
  - SA: Environmental management, Resource management
- Coasts
  - SA: Bays, Beaches, Coastal waters, Harbors, Ports, Shorelines
- Cold Climates
  - SA: Arctic, Arctic Ocean, Subarctic regions
- Compensation
  - SA: Insurance, Liability
- Concentrations
  - SA: Analytical techniques, Chemical analysis, Chromatography, Detection
- Connecticut
- Conservation
  - SA: Coastal zone management, Environmental management, Resource management
- Containment
  - S: Booms, Equipment, Spill cleanup, Spill containment
- Contamination
- Contingency planning
  - SA: Spill cooperatives, Spill response
- Coral reefs
- Cost analysis
  - SA: Economics, Economic effects
- Crankcase oil
  - SA: Lubricating oil
- Crude oil
  - SA: Aromatic hydrocarbons, Hydrocarbons
- Crude oil washing
  - SA: Ballast, Oil discharges, Segregated ballast, Tankers
- Crustaceans
  - SA: Invertebrates, Marine organisms
- Deepwater ports

- Degradation
  - SA: Biodegradation
  - SA: Harbors, Oil terminals, Ports
- Delaware
- Delaware Bay
- Demulsification
- Denmark
- Depuration
  - SA: Uptake
- Design-engineering
  - SA: Equipment, Patent, Performance testing, Product information
- Detection
  - SA: Analytical techniques, Bioindicators, Chemical analysis, Monitoring, Remote sensing, Source identification, Surveillance
- Development
  - SA: (Oil) Drilling, Exploration, Offshore, Production;
  - SA: (Biological) Behavior, Biological effects, Growth, Metabolism
- Diesel fuel
  - S: Fuel oil
- Dispersants
  - SA: Emulsifiers, Spill cleanup, Surfactants
- Dispersion
  - SA: Behavior, Drift, Movement, Spreading
- Disposal
  - SA: Waste oil, Wastewaters
- Distribution
  - SA: Concentrations, Hydrocarbons
- DOE (Department of Energy)
  - SA: Government agencies, US government
- Drift
  - SA: Behavior, Dispersion, Models, Movement, Simulations, Spreading
- Drilling
  - SA: Exploration, Offshore, Oil fields, Oil wells, Platforms
- Echinoderms
  - S: Invertebrates, Marine organisms
- Economic effects
  - SA: Socioeconomic effects
- Economics
  - SA: Cost analysis
- Ecosystems
  - SA: Food web, Habitats, Niches
- Ecuador
- Effluents
  - S: Wastewaters
- Effluent treatment
  - S: Wastewater treatment
- EIS (Environmental Impact Statement)
  - SA: Baseline studies
- Ekofisk blowout
- Emulsification
  - SA: Dispersants, Surfactants
- Emulsions
- Engineering
  - S: Design-engineering
- England
  - S: UK
- English Channel
- Environmental effects
- Environmental Impact Statement
  - S: Baseline studies, EIS
- Environmental management
  - S: Coastal zone management, Resource management
- Environmental protection
  - S: Pollution control, Pollution prevention
- EPA (Environmental Protection Agency)
  - SA: Government agencies, US government
- Equipment
  - SA: Booms, Patents, Product information, Skimmers, Spill cleanup
- ERDA (Energy Research and Development Administration)
  - SA: DOE, Government agencies, US government
- Estuaries
  - SA: Bays
- Europe
- Evaporation
- Exploration
  - SA: Development, Drilling, Offshore, Production

Extraction
  SA: Oil shale, Production, Tar sands
Fate
  SA: Behavior, Drift, Spreading
FEA (Federal Energy Administration)
  SA: DOE, ERDA, Government agencies, US government
Field testing
  S: Performance testing
Filtration
  SA: Flocculation, Wastewater treatment
Fingerprinting
  S: Source identification
Finland
Fish
  SA: Vertebrates, Marine organisms
Fisheries
Flocculation
  SA: Coalescence, Filtration, Wastewater treatment
Florida
Florida spill
Flotation
  SA: Oil-water separation, Wastewater treatment
Food chain
  S: Food web
Food web
Foreign governments
  SA: Government agencies
Fossil fuels
  SA: Crude oil
France
Freshwater
  SA: Groundwater, Lakes, Rivers, Water quality
Fuel oil
Fuels
  S: Fossil fuels, Fuel oil, Gasoline, Petroleum products
Fungi
  SA: Microorganisms
Gas-liquid chromatography
  S: Chemical analysis, Chromatography
Gasoline
  SA: Fuel oil
GC/MS (Gas chromatography/Mass spectrometry)
  SA: Analytical techniques, Chemical analysis, Chromatography, Spectrometry
Georges Bank
  SA: Atlantic Ocean, OCS
Georgia
Germany
Government agencies
  SA: BLM, DOE, EPA, ERDA, FEA, NOAA, USCG, USGS, USN; Foreign governments, State governments, US government
Gravity separation
  SA: Oil-water separation, Wastewater treatment
Great Britain
  S: UK
Great Lakes
Greenland
Groundwater
  SA: Freshwater, Water quality
Growth
  SA: Behavior, Development, Metabolism
Guidelines
  SA: Manuals, Regulations
Gulf of Alaska
  SA: Alaska
Gulf of Mexico
  SA: Mexico
Habitats
  SA: Ecosystems
Harbors
  SA: Bays, Coastal waters, Deepwater ports, Oil terminals, Ports
Health hazards
  SA: Carcinogens
Hydrocarbons
  SA: Aromatic hydrocarbons, Biogenic hydrocarbons, Crude oil, PAH, WSF
Ice
  SA: Arctic, Subarctic regions
Illinois
IMCO (International Maritime Consultative Organization)
  SA: International agreements
Incineration
  SA: Burning, Waste oil treatment

- India
- Indian Ocean
- Indonesia
- Industries
  - SA: Oil industry, Petrochemicals
- Information systems
- Infrared spectroscopy
  - S: Analytical techniques, Spectroscopy
- Insurance
  - SA: Compensation, Liability
- International agreements
  - SA: Foreign governments
- International conventions
  - SA: Foreign governments, Legislation, Regulations
- Intertidal zone
  - SA: Beaches, Coastal Waters, Shorelines
- Invertebrates
  - SA: Benthos, Crustaceans, Echinoderms, Marine organisms, Mollusks
- Iran
- Ireland
  - SA: UK
- Israel
- Italy
- Ixtoc 1 blowout
  - SA: Gulf of Mexico, Mexico
- Japan
- Kuwait
- Labrador Sea
- Lakes
  - SA: Freshwater, Great Lakes
- Land farming
  - SA: Waste oil disposal
- Land spills
  - SA: Leakage, Onshore, Onshore impacts, Pipelines
- Law enforcement
  - SA: Legislation, Regulations, Surveillance
- Leakage
  - SA: Oil discharges
- Legislation
  - SA: International conventions, Law enforcement Regulations
- Liability
  - SA: Compensation, Insurance, Law enforcement
- Lightering
  - S: Oil transfer, Ships, Tankers
- Louisiana
- Lubricating oil
  - SA: Crankcase oil
- Maine
- Manuals
  - SA: Guidelines
- Marine environment
  - SA: Offshore, Sea surface, Seawater
- Marine mammals
  - SA: Animals, Vertebrates, Wildlife
- Marine organisms
  - SA: Animals, Annelids, Crustaceans, Echinoderms, Fish, Invertebrates, Microorganisms, Mollusks, Vertbrates
- Marshes
- Maryland
- Massachusetts
- Mass spectrometry
  - S: GC/MS, Spectrometry
- Mass spectroscopy
  - S: Spectroscopy
- Mediterranean Sea
- Metabolism
  - SA: Depuration, Growth, Uptake
- Metula spill
  - SA: Strait of Magellan
- Mexico
  - SA: Gulf of Mexico
- Michigan
  - SA: Great Lakes
- Microorganisms
  - SA: Algae, Bacteria, Biodegradation, Fungi, Yeasts
- Mississippi
- Mississippi River
- Models
  - SA: Behavior, Predictions, Simulations, Spill trajectories
- Mollusks
  - SA: Invertebrates, Marine organisms
- Monitoring
  - SA: Detection, Remote sensing, Sampling, Surveillance
- Mortality
  - SA: Acute effects, Toxicity

- Motor oil
  - S: Crankcase oil
- Mousse
  - S: Emulsions, Emulsification
- Movement
  - SA: Behavior, Drift, Spreading
- Mutagens
  - SA: Carcinogens, Health hazards
- Narragansett Bay
  - SA: Rhode Island
- Natural seepage
  - SA: Santa Barbara Channel
- New Jersey
- New York
- Niches
  - S: Ecosystems, Habitats
- NOAA (National Oceanic and Atmospheric Adminstration)
  - SA: Government agencies, US government
- North Carolina
- North Sea
- Norway
- Oceans
  - S: Arctic Ocean, Atlantic Ocean, Indian Ocean, Marine environment, Pacific Ocean
- OCS (Outer Continental Shelf)
  - SA: Development, Drilling, Exploration, Offshore, Oil fields, Oil-gas leasing, Production
- Offloading
  - S: Oil transfer, Ships, Tankers
- Offshore
  - SA: Development, Drilling, Exploration, OCS, Oil fields, Oil-gas leasing, Oil wells, Platforms, Production
- Oil
  - S: Crankcase oil, Crude oil, Fossil fuels, Fuel oil, Lubricating oil, Oil shale, Petroleum products, Residual oils, Tar, Tar sands, Waste oil, WSF
- Oil discharges
  - SA: Leakage
- Oil fields
  - SA: Offshore, Platforms, Production
- Oil-gas leasing
  - SA: Development, Drilling, OCS, Offshore, Production
- Oil industry
  - SA: Industries, Petrochemicals, Refineries
- Oil removal
  - SA: Pollution control, Spill cleanup, Spill removal
- Oil sands
  - S: Tar sands
- Oil shale
  - SA: Extraction
- Oil slicks
- Oil spills
  - SA: Spill cleanup, Spill containment, Spill disposal, Spill removal, Spill response
- Oil tanks
  - SA: Storage
- Oil terminals
  - SA: Deepwater ports, Harbors, Oil transfer, Ports
- Oil transfer
  - SA: Harbors, Ports
- Oil transport
  - SA: Pipelines, Tankers
- Oil-water separation
  - SA: Gravity separation, Waste oil treatment, Wastewater treatment
- Oil wells
  - SA: Drilling, Offshore, Oil fields, Production
- Olympic Games spill
- Onshore
  - SA: Land spills
- Onshore impacts
- Oregon
- Oxidation
  - SA: Biodegradation, Weathering
- Pacific coast
- Pacific Ocean
- PAH (Polycyclic aromatic hydrocarbons)
  - SA: Aromatic hydrocarbons, Hydrocarbons
- Patent
  - SA: Design-engineering, Equipment
- Pennsylvania

- Performance testing
  - SA: Design-engineering, Equipment, Product information
- Persian Gulf
- Personnel training
  - SA: Contingency planning, Spill response
- Petrochemicals
- Petroleum
  - S: Hydrocarbons, Petroleum products
- Petroleum industry
  - S: Oil industry, Refineries
- Petroleum products
  - SA: Crankcase oil, Fuel oil, Fuels, Gasoline, Lubricating oil
- Philippines
- Physical aspects
- Physical effects
  - SA: Behavior, Drift, Movement
- Phytoplankton
  - SA: Algae, Microorganisms, Plankton
- Pipelines
  - SA: Oil transfer, Oil transport, Trans-Alaska Pipeline
- Plankton
  - S: Microorganisms, Phytoplankton, Zooplankton
- Plants
  - SA: Vegetation
- Platforms
  - SA: Drilling, Exploration, Offshore, Production, Oil wells
- Pollution control
- Pollution prevention
  - SA: Environmental protection, Contingency planning
- Polychaetes
  - S: Annelids, Invertebrates, Marine organisms
- Ports
  - SA: Deepwater ports, Harbors, Oil terminals
- Portugal
- Predictions
  - SA: Models, Simulations, Spill trajectories
- Product information
  - SA: Design-engineering, Equipment, Performance testing
- Production
  - SA: Development, Drilling, Exploration, Offshore
- Prudhoe Bay
  - SA: Alaska, Gulf of Alaska
- Puerto Rico
- Puget Sound
  - SA: Washington
- Reclamation
  - SA: Recycling, Reuse
- Recovery
  - SA: Restoration
- Recycling
  - SA: Reclamation, Reuse
- Red Sea
- Refineries
  - SA: Oil industry
- Refining
- Regulations
  - SA: Government agencies, Guidelines, International agreements, International conventions, Legislation
- Release
  - S: Depuration
- Remote sensing
  - SA: Detection, Monitoring, Source identification, Surveillance
- Reproduction
- Residual oils
  - S: Tar, Waste oil
- Resource management
  - SA: Coastal zone management
- Restoration
  - SA: Recovery
- Reuse
  - SA: Reclamation, Recycling
- Rhine River
  - SA: Germany, Mediterranean Sea
- Rhode Island
- Risk analysis
  - SA: Economics, Statistical analysis, Statistics
- Rivers
  - SA: Freshwater, Onshore
- Russia
  - S: USSR

- Safety
  - SA: Health hazards
- Sampling
  - SA: Detection, Monitoring, Source identification
- San Francisco Bay
  - SA: California
- Sansinena spill
- Santa Barbara Channel
  - SA: California
- Sargasso Sea
  - S: Atlantic Ocean
- Scotland
  - SA: UK
- Seabirds
  - S: Birds
- Sea surface
- Seawater
  - SA: Marine environment, Sea surface
- Sedimentation
- Sediments
  - SA: Soil
- Segregated ballast
  - SA: Ballast, Crude oil washing, Tankers
- Ships
  - SA: Tankers
- Shorelines
  - SA: Beaches, Coasts
- Simulations
  - SA: Models, Predictions
- Sinking agents
- Skimmers
  - SA: Design-engineering, Equipment, Spill cleanup
- Sludge
  - SA: Activated sludge, Solid wastes
- Socioeconomic effects
  - SA: Economic effects
- Soil
  - SA: Sediments
- Solid wastes
  - SA: Disposal, Sludge
- Solubility
- Solution
- Solvents
  - S: Dispersants, Emulsifiers
- Sorbents
  - SA: Absorption, Adsorption
- Source identification
  - SA: Detection, Monitoring, Remote sensing, Sampling, Surveillance
- Sources
- South Carolina
- Soviet Union
  - S: USSR
- Spain
- Spectrometry
  - SA: Analytical techniques, Chemical analysis, GC/MS
- Spectroscopy
  - SA: Analytical techniques, Chemical analysis
- Spill cleanup
  - SA: Booms, Dispersants, Equipment, Pollution control, Sinking agents, Skimmers, Spill containment
- Spill containment
- Spill cooperatives
  - SA: Contingency planning, Spill cleanup, Spill response
- Spill disposal
- Spill removal
- Spill response
  - SA: Contingency planning, Spill cleanup, Spill cooperatives
- Spill trajectories
  - SA: Drift, Models, Movement, Predictions
- Spreading
  - SA: Behavior, Drift, Models, Movement, Oil slicks
- St. Lawrence River
  - SA: Great Lakes
- State governments
  - SA: Government agencies, Regulations
- Statistical analysis
- Statistics
- Storage
  - SA: Oil tanks
- Strait of Magellan
  - SA: Chili
- Strategic Petroleum Reserve
- Streams
  - S: Freshwater, Onshore, Rivers

Subarctic regions
  SA: Arctic, Cold climates
Sublethal effects
  SA: Biological effects, Toxicity
Superports
  S: Deepwater ports, Oil terminals, Ports
Supertankers
  S: Tankers
Surfactants
  SA: Dispersants, Emulsifiers
Surveillance
  SA: Law enforcement, Monitoring, Remote sensing
Sweden
Tainting
  S: Contamination
Tank farms
  S: Oil tanks, Storage
Tankers
  SA: Oil transport, Ships
Tar
  SA: Residual oils
Tar sands
Testing
  S: Performance testing
Texas
Torrey Canyon spill
Toxicity
  SA: Acute effects, Biological effects
Trans-Alaska Pipeline
  SA: Alaska, Pipelines
Tropical regions
UK (United Kingdom)
Ultrafiltration
  S: Filtration
UN (United Nations)
  SA: International agreements, International conventions
Uptake
  SA: Depuration, Growth, Metabolism
Urquiola spill
  SA: Spain
US (United States)
USCG (US Coast Guard)
US Government
  SA: Government agencies
USGS (US Geological Survey)
  SA: Government agencies, US government
USN (US Navy)
USSR (Union of Soviet Socialist Republics)
Vegetation
  SA: Plants
Venezuela
Vertebrates
  SA: Animals, Birds, Marine mammals, Marine organisms
Virgin Islands
Virginia
Washington
Waste oil
  SA: Disposal, Reclamation, Recycling, Residual oils
Waste oil treatment
Wastewaters
Wastewater treatment
  SA: Oil-water separation
Waterfowl
  S: Birds
Water quality
  SA: Freshwater, Groundwater
Water soluble fraction
  S: WSF
Weathering
Wildlife
  SA: Animals, Birds, Marine organisms, Marine mammals
WSF (Water soluble fraction)
  SA: Crude oil, Hydrocarbons, Solution
Yeasts
  SA: Microorganisms
Zooplankton
  SA: Microorganisms, Plankton

1180 ABSORPTION, SORBENTS, POLLUTION PREVENTION, EQUIPMENT, PATENT, *BILGES
1185 " SORBENTS, PLANTS, PATENT, *GRASS PEAT FIBERS
1206 " OIL REMOVAL, SORBENTS, PATENT
1210 " SPILL REMOVAL, OIL-WATER SEPARATION, SKIMMERS, DISPERSANTS, SORBENTS, FLOTATION, EQUIPMENT, SPREADING, BIBLIOGRAPHIES
1452 " OIL-WATER SEPARATION, *SORBENT FOAM
1441 ACTIVATED SLUDGE, WASTEWATER TREATMENT, PATENT
1192 ACUTE EFFECTS, SPILL CLEANUP, DISPERSANTS, TOXICITY, CHRONIC EFFECTS, MARINE ORGANISMS, HABITATS
1255 " DISPERSANTS, TOXICITY, PERFORMANCE TESTING, CANADA
1196 ADSORPTION, SPILL CLEANUP, WASTEWATER TREATMENT, PATENT, *POWDERED SHALE
1217 " SORBENTS, OIL REMOVAL, PATENT
1368 " CRUDE OIL, DISTRIBUTION, MOVEMENT, SIMULATIONS, SEDIMENTS, PUGET SOUND
1414 " WASTEWATER TREATMENT, OIL INDUSTRY, *PHENOL REMOVAL
1427 " WASTEWATER TREATMENT, OIL REMOVAL, PERFORMANCE TESTING, *FOAM SEPARATION
1428 " WASTEWATER TREATMENT, REFINERIES, PETROCHEMICALS, BIBLIOGRAPHIES, *ACTIVATED CARBON
1435 " WASTEWATER TREATMENT, SORBENTS, PATENT
1442 " WASTEWATER TREATMENT, OIL REMOVAL, PATENT
1307 ALASKA , BASELINE STUDIES, OFFSHORE, DEVELOPMENT, PRUDHOE BAY
1310 " OCS, DEVELOPMENT, BASELINE STUDIES, AQUATIC ENVIRONMENT, MARINE ORGANISMS
1449 " WASTE OIL TREATMENT, ENVIRONMENTAL EFFECTS, DISPOSAL
1247 ALGAE, CRUDE OIL, FUEL OIL, AROMATIC HYDROCARBONS, WSF, TOXICITY, MICROORGANISMS
1248 " CRUDE OIL, FUEL OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, PAH, TOXICITY
1291 " FUEL OIL, BIOINDICATORS, TOXICITY, ANALYTICAL TECHNIQUES, INVERTEBRATES, *SPECIES DIVERSITY
1339 " BIODEGRADATION, OIL SPILLS, BACTERIA, SPILL CLEANUP, BIBLIOGRAPHIES
R106 " CRUDE OIL, FUEL OIL, TOXICITY, REPRODUCTION, WATER QUALITY
1194 AMOCO CADIZ SPILL, SPILL CLEANUP, PHYSICAL ASPECTS, BEHAVIOR, POLLUTION CONTROL, FRANCE
1221 " CONTINGENCY PLANNING, SPILL CLEANUP, POLLUTION CONTROL, COASTS, FRANCE
1238 " SPILL CLEANUP, ENVIRONMENTAL EFFECTS, COASTS, MORTALITY, BIRDS, MARINE ORGANISMS, FISHERIES, FRANCE
1243 " BIOLOGICAL EFFECTS, MORTALITY, BIRDS, MARINE ORGANISMS, FISHERIES
1253 " BIOLOGICAL EFFECTS, SHORELINES, MORTALITY, BIRDS, FISHERIES, FRANCE
1254 " BIOLOGICAL EFFECTS, SHORELINES, MORTALITY, BIRDS, FISHERIES, FRANCE
1263 " BIOLOGICAL EFFECTS, BENTHOS, INVERTEBRATES, ONSHORE, TOXICITY, FRANCE
1284 " MARINE ORGANISMS, FISHERIES, ENVIRONMENTAL EFFECTS, MORTALITY, FRANCE
1295 " WEATHERING, CHEMICAL EFFECTS, EMULSIONS, AROMATIC HYDROCARBONS, FRANCE
1296 " WEATHERING, CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, FRANCE
1299 " PHYSICAL ASPECTS, PHYSICAL EFFECTS, CRUDE OIL, MOVEMENT, DISTRIBUTION, FRANCE
1300 " SHORELINES, BEACHES, SEDIMENTS, CRUDE OIL, DISTRIBUTION, PHYSICAL ASPECTS, FRANCE
1301 " SHORELINES, SEDIMENTS, CRUDE OIL, DISTRIBUTION, PHYSICAL EFFECTS, FRANCE
1315 " OIL SPILLS, ENVIRONMENTAL EFFECTS, CONTAMINATION, SPILL REMOVAL, FRANCE
1324 " SPILL CLEANUP, REMOTE SENSING, BEACHES, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, FRANCE
1325 " SPILL CLEANUP, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, NOAA, EPA, FRANCE
1119 ANALYTICAL TECHNIQUES, CONCENTRATIONS, DETECTION, PATENT, OIL-IN-WATER, *FLUORESCENCE
1120 " MONITORING, WASTEWATERS, CONTAMINATION, TOXICITY, GREAT LAKES
1123 " CONTAMINATION, MUTAGENS, BIOLOGICAL EFFECTS, DETECTION
1125 " PAH, HYDROCARBONS , EXTRACTION, DETECTION, WASTEWATERS, REFINERIES, *FLUOROMETRY
1128 " DETECTION, CONCENTRATIONS, *OIL-IN-WATER
1129 " DETECTION, CONCENTRATIONS, HYDROCARBONS , SPECTROMETRY, SEAWATER
1130 " PAH, WASTEWATERS, *FLUOROMETRY
1133 " HYDROCARBONS , SOIL, EQUIPMENT, DESIGN-ENGINEERING, PATENT, *VOLATILIZATION
1134 " HYDROCARBONS , SOIL, EQUIPMENT, DESIGN-ENGINEERING, PATENT, DETECTION
1139 " DETECTION, PAH, *FLUORESCENCE
1140 " SAMPLING, REMOTE SENSING, DETECTION, OIL SPILLS, WASTEWATERS, BIBLIOGRAPHIES
1143 " CHEMICAL ANALYSIS, HYDROCARBONS , CHROMATOGRAPHY, GEORGES BANK, ARGO MERCHANT SPILL
1145 " SAMPLING, PHYSICAL ASPECTS, ARGO MERCHANT SPILL
1147 " WASTEWATERS, SEDIMENTS, HYDROCARBONS , BIOGENIC HYDROCARBONS, MANUALS
1148 " PAH, CHROMATOGRAPHY
1149 " PETROLEUM PRODUCTS, CRUDE OIL, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION
1150 " CHROMATOGRAPHY, SEDIMENTS, HYDROCARBONS , *TLC, *COLUMN CHROMATOGRAPHY
1151 " SAMPLING, CHROMATOGRAPHY, CRUDE OIL, PETROLEUM PRODUCTS
1152 " SAMPLING, TAR, JAPAN, CHROMATOGRAPHY, SOURCE IDENTIFICATION
1154 " HYDROCARBONS , SEDIMENTS, CHROMATOGRAPHY, MOVEMENT, ARGO MERCHANT SPILL
1155 " WSF, CONCENTRATIONS, SAMPLING, ARGO MERCHANT SPILL, *FLUORESCENCE SPECTROSCOPY
1158 " CHEMICAL ANALYSIS, DISPOSAL , HYDROCARBONS , WASTEWATERS
1159 " HYDROCARBONS , SAMPLING, MARINE ORGANISMS, SEDIMENTS, FISH, ARGO MERCHANT SPILL
1160 " HYDROCARBONS , WSF
1162 " PAH, SPECTROSCOPY, BAYS, NEW YORK
1164 " PETROLEUM PRODUCTS, SOURCE IDENTIFICATION
1169 " SOURCE IDENTIFICATION, GC/MS, HYDROCARBONS , SEDIMENTS, WEATHERING, DETECTION
1170 " SOURCE IDENTIFICATION, DETECTION, CHROMATOGRAPHY, MANUALS

1171 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, TAR, CALIFORNIA, *SANTA MONICA BAY, NATURAL SEEPAGE, WEATHERING
1172 " SOURCE IDENTIFICATION, FUEL OIL, CRUDE OIL
1173 " SOURCE IDENTIFICATION, CONTAMINATION, *NI/N INDEX
1174 " SOURCE IDENTIFICATION, OIL SPILLS
1256 " BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, *PROCEEDINGS
1280 " BIOLOGICAL EFFECTS, ZOOPLANKTON, CRUSTACEANS, ARGO MERCHANT SPILL, *SPECTROFLUOROMETRY
1291 " ALGAE, FUEL OIL, BIOINDICATORS, TOXICITY, INVERTEBRATES, *SPECIES DIVERSITY
1327 " CONCENTRATIONS, DETECTION, SEDIMENTS, HYDROCARBONS
1430 " WASTE OIL TREATMENT, PETROLEUM PRODUCTS, BIODEGRADATION
R089 " CHEMICAL ANALYSIS, OIL DISCHARGES, WASTEWATERS, POLLUTION CONTROL
1127 ANIMALS, DETECTION, BIOINDICATORS, MICROORGANISMS, PLANTS, FISH, BIBLIOGRAPHIES
1273 " ECOSYSTEMS, BIBLIOGRAPHIES, PLANTS, ARCTIC
1293 " BIOLOGICAL EFFECTS, TOXICITY, CONTAMINATION, MARINE MAMMALS, *SEA OTTER
1310 AQUATIC ENVIRONMENT, ALASKA , OCS, DEVELOPMENT, BASELINE STUDIES, MARINE ORGANISMS
1316 " BIOLOGICAL EFFECTS, BIODEGRADATION, FATE, MOVEMENT
1326 " CONTAMINATION, FATE, BIOLOGICAL EFFECTS, ECOSYSTEMS
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R104 " BIOASSAY, FISH, TOXICITY, OIL SHALE, PETROLEUM PRODUCTS
1369 CARIBBEAN SEA, BIOLOGICAL EFFECTS, NATURAL SEEPAGE, FATE, HYDROCARBONS , TEXAS, GULF OF MEXICO
1117 CHEMICAL ANALYSIS, SAMPLING, FRESHWATER, SOILS, SEDIMENTS
1121 " AROMATIC HYDROCARBONS, DETECTION, CONCENTRATIONS, SPECTROSCOPY
1135 " SAMPLING, PAH, CHROMATOGRAPHY, DETECTION, CONCENTRATIONS
1138 " MONITORING, WASTEWATER TREATMENT, RIVERS, EQUIPMENT, DESIGN-ENGINEERING, INDIA
1143 " ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, HYDROCARBONS , CHROMATOGRAPHY, GEORGES BANK
1144 " HYDROCARBONS , DISPERSION, DISPERSANTS, CONCENTRATIONS
1146 " BIOGENIC HYDROCARBONS, SAMPLING, DETECTION, HYDROCARBONS
1149 " ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, CRUDE OIL, SOURCE IDENTIFICATION
1153 " SAMPLING, CHROMATOGRAPHY, SPECTROMETRY, WEATHERING
1156 " AROMATIC HYDROCARBONS, FISH, MOLLUSKS, CONTAMINATION, *FREEZE DRYING
1157 " HYDROCARBONS , SOURCE IDENTIFICATION, CONTAMINATION, MARINE ORGANISMS, HARBORS, *TAIWAN
1158 " ANALYTICAL TECHNIQUES, DISPOSAL , HYDROCARBONS , WASTEWATERS
1161 " BEACHES, SOIL, HYDROCARBONS , SURFACTANTS
1163 " BIOLOGICAL EFFECTS, CONCENTRATIONS, CONTAMINATION, SURFACTANTS, FISH, JAPAN
1166 " SOURCE IDENTIFICATION, CRUDE OIL, CHROMATOGRAPHY
1278 " MOLLUSKS, PAH, CONCENTRATIONS, UPTAKE, *CLAMS
1336 " BIODEGRADATION, CRUDE OIL, CONCENTRATIONS, HYDROCARBONS
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1356 " OXIDATION, CRUDE OIL, HYDROCARBONS , SEAWATER
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R090 " WATER QUALITY, EQUIPMENT, EPA, SAMPLING
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1279 CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, FISH, INVERTEBRATES, HYDROCARBONS *MIXED-FUNCTION OXIDASE ACTIVITY
1295 " AROMATIC HYDROCARBONS, AMOCO CADIZ SPILL, WEATHERING, EMULSIONS, FRANCE
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1297 " BEHAVIOR, SURFACTANTS, DISPERSION, PHYSICAL ASPECTS
1318 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, OIL SPILLS, PHYSICAL EFFECTS, SOCIOECONOMIC EFFECTS, *PROCEEDINGS
1324 " BIOLOGICAL EFFECTS, BEACHES, AMOCO CADIZ SPILL, SPILL CLEANUP, REMOTE SENSING, DISTRIBUTION, FRANCE
1325 " BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL CLEANUP, DISTRIBUTION, NOAA, EPA, FRANCE
R108 " WSF, PHYSICAL EFFECTS, GROUNDWATER, CONTAMINATION, CHROMATOGRAPHY
1135 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING, PAH, DETECTION, CONCENTRATIONS
1143 " CHEMICAL ANALYSIS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, HYDROCARBONS , GEORGES BANK
1148 " ANALYTICAL TECHNIQUES, PAH
1150 " ANALYTICAL TECHNIQUES, SEDIMENTS, HYDROCARBONS , *TLC, *COLUMN CHROMATOGRAPHY
1151 " ANALYTICAL TECHNIQUES, SAMPLING, CRUDE OIL, PETROLEUM PRODUCTS
1152 " ANALYTICAL TECHNIQUES, SAMPLING, TAR, JAPAN, SOURCE IDENTIFICATION
1153 " CHEMICAL ANALYSIS, SAMPLING, SPECTROMETRY, WEATHERING
1154 " ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, HYDROCARBONS , SEDIMENTS, MOVEMENT
1166 " CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CRUDE OIL
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R088 " MONITORING, EQUIPMENT, WASTEWATERS, OIL INDUSTRY
R094 " SOURCE IDENTIFICATION, CRUDE OIL, PETROLEUM PRODUCTS, DETECTION, CHEMICAL ANALYSIS, SEDIMENTS, *FINGERPRINTING
R108 " CHEMICAL EFFECTS, WSF, PHYSICAL EFFECTS, GROUNDWATER, CONTAMINATION
1192 CHRONIC EFFECTS, ACUTE EFFECTS, SPILL CLEANUP, DISPERSANTS, TOXICITY, MARINE ORGANISMS, HABITATS
1244 " BIOLOGICAL EFFECTS, FATE, OIL SPILLS, HEALTH HAZARDS, MARINE ENVIRONMENT
1262 " TOXICITY, MUTAGENS, CRUDE OIL
1275 " CARCINOGENS, BIOLOGICAL EFFECTS, PAH, HEALTH HAZARDS
1283 " BIRDS, CONTAMINATION, SUBLETHAL EFFECTS, *STERNA FUSCATA
1455 COALESCENCE, OIL-WATER SEPARATION, EQUIPMENT, FILTRATION, PATENT
1236 COASTAL WATERS, DISPERSANTS, SPILL CLEANUP, POLLUTION CONTROL, CONTINGENCY PLANNING
1261 " BIRDS, NEW YORK, ENVIRONMENTAL EFFECTS
1221 COASTS, AMOCO CADIZ SPILL, CONTINGENCY PLANNING, SPILL CLEANUP, POLLUTION CONTROL, FRANCE

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1382 " ENVIRONMENTAL EFFECTS, RESOURCE MANAGEMENT, OIL INDUSTRY
1411 " BALLAST , STATISTICS, OIL TRANSPORT, TANKERS, TAR, OIL SPILLS, POLLUTION CONTROL, KUWAIT
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1329 " BOOK REVIEW, BIRDS, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, FATE, WEATHERING, FISH, *TRANSPORT
1370 " BIODEGRADATION, PAH, FATE, WEATHERING, ZOOPLANKTON, UPTAKE, SEDIMENTS, ECOSYSTEMS
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1135 " CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING, PAH, DETECTION
1136 " SAMPLING, DETECTION, WASTE OIL
1137 " WASTEWATERS, DETECTION, TANKERS, PATENT, *OPTICAL METHOD
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1155 " ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, WSF, SAMPLING, *FLUORESCENCE SPECTROSCOPY
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1336 " CHEMICAL ANALYSIS, BIODEGRADATION, CRUDE OIL, HYDROCARBONS
1359 " PAH, DISTRIBUTION, FATE, SOIL, SEDIMENTS, *POLLUTANT TRANSPORT
1380 " OIL FIELDS, CRUDE OIL, ENVIRONMENTAL EFFECTS, MARINE ENVIRONMENT, DEVELOPMENT
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1156 " CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, FISH, MOLLUSKS, *FREEZE DRYING
1157 " CHEMICAL ANALYSIS, HYDROCARBONS , SOURCE IDENTIFICATION, MARINE ORGANISMS, HARBORS, *TAIWAN
1163 " CONCENTRATIONS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, SURFACTANTS, FISH, JAPAN
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1227 " OIL TERMINALS, POLLUTION PREVENTION, SPILL CLEANUP, SCOTLAND, *SULLOM VOE
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1432 CRANKCASE OIL, WASTE OIL, DISPOSAL , RECYCLING
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1218 " SPILL CLEANUP, MARSHES, RESTORATION, RECOVERY, SOIL, PLANTS, INVERTEBRATES
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1248 " BIOLOGICAL EFFECTS, ALGAE, FUEL OIL, MICROORGANISMS, PAH, TOXICITY
1257 " FISH, TOXICITY, *PLASMA, *COPPER
1260 " BIRDS, TOXICITY, DEVELOPMENT, GROWTH, MORTALITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY
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1300 " BEACHES, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, DISTRIBUTION, PHYSICAL ASPECTS, FRANCE
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1336 " CONCENTRATIONS, CHEMICAL ANALYSIS, BIODEGRADATION, HYDROCARBONS
1340 " BIODEGRADATION, MICROORGANISMS, *VITAMINS
1344 " BIODEGRADATION, DISPERSANTS, MICROORGANISMS, HYDROCARBONS
1347 " CHEMICAL ANALYSIS, WEATHERING, SOURCE IDENTIFICATION
1356 " CHEMICAL ANALYSIS, OXIDATION, HYDROCARBONS , SEAWATER
1361 " CORAL REEFS, BIOLOGICAL EFFECTS, BACTERIA, MODELS, SUBLETHAL EFFECTS
1368 " ADSORPTION, DISTRIBUTION, MOVEMENT, SIMULATIONS, SEDIMENTS, PUGET SOUND
1380 " CONCENTRATIONS, OIL FIELDS, ENVIRONMENTAL EFFECTS, MARINE ENVIRONMENT, DEVELOPMENT
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1280 CRUSTACEANS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, ZOOPLANKTON, *SPECTROFLUOROMETRY
1285 " BIOLOGICAL EFFECTS, BASELINE STUDIES, ARGO MERCHANT SPILL, FISH, MOLLUSKS, *HISTOPATHOLOGY
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1401 DEEPWATER PORTS, OIL TRANSFER, POLLUTION PREVENTION, TANKERS, *TRANSFER CONTROL SYSTEMS
1410 " REGULATIONS, POLLUTION PREVENTION, *OIL TRANSFER SYSTEM
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1446 " WASTEWATER TREATMENT, PATENT
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1274 " CRUDE OIL, HYDROCARBONS , MOLLUSKS, UPTAKE, FOOD WEB
1133 DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, EQUIPMENT, PATENT, *VOLATILIZATION
1134 " ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, EQUIPMENT, PATENT, DETECTION
1138 " CHEMICAL ANALYSIS, MONITORING, WASTEWATER TREATMENT, RIVERS, EQUIPMENT, INDIA
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1179 " BOOMS, SPILL CONTAINMENT, EQUIPMENT, SIMULATIONS
1181 " BOOMS, SPILL CONTAINMENT, EQUIPMENT, PATENT
1182 " SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, EPA, US, USSR, *OHMSETT FACILITY
1184 " DISPERSANTS, EQUIPMENT, PERFORMANCE TESTING, POLLUTION CONTROL
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1200 " DISPERSANTS, EQUIPMENT, US, USSR, EPA, PERFORMANCE TESTING, *OHMSETT FACILITY
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1203 " BOOMS, OIL REMOVAL, SKIMMERS, FILTRATION, GRAVITY SEPARATION, EQUIPMENT, PATENT
1204 " SPILL CLEANUP, SKIMMERS, EQUIPMENT, PATENT
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1208 " SPILL CLEANUP, SPILL REMOVAL, SHIPS, EQUIPMENT, PATENT
1209 " SPILL CLEANUP, OIL-WATER SEPARATION, SKIMMERS, SEA SURFACE, EQUIPMENT, PATENT
1211 " SPILL CLEANUP, EQUIPMENT, DISPERSANTS, *DISPERSANT APPLICATION
1212 " SKIMMERS, EQUIPMENT, SPILL CLEANUP, PERFORMANCE TESTING, *OHMSETT FACILITY
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1413 DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EQUIPMENT, PATENT
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1444 " WASTEWATER TREATMENT, OIL REMOVAL, EQUIPMENT, PATENT
1451 " OIL-WATER SEPARATION, GRAVITY SEPARATION, WASTEWATER TREATMENT, EQUIPMENT
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1119 " CONCENTRATIONS, ANALYTICAL TECHNIQUES, PATENT, OIL-IN-WATER, *FLUORESCENCE
1121 " CONCENTRATIONS, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, SPECTROSCOPY
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1123 " CONTAMINATION, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, MUTAGENS
1125 " ANALYTICAL TECHNIQUES, PAH, HYDROCARBONS , EXTRACTION, WASTEWATERS, REFINERIES, *FLUOROMETRY
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1134 " DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, EQUIPMENT, PATENT
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1136 " CONCENTRATIONS, SAMPLING, WASTE OIL
1137 " CONCENTRATIONS, WASTEWATERS, TANKERS, PATENT, *OPTICAL METHOD
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1141 " BIBLIOGRAPHIES, REMOTE SENSING, OIL SPILLS, DISPERSION, FATE, ESTUARIES
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1169 " ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, GC/MS, HYDROCARBONS , SEDIMENTS, WEATHERING
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1304 " OCS, SOCIOECONOMIC EFFECTS, OIL INDUSTRY
1307 " BASELINE STUDIES, ALASKA , OFFSHORE, PRUDHOE BAY
1308 " BASELINE STUDIES, ATLANTIC COAST, PAH, FISH, OCS, OFFSHORE
1310 " BASELINE STUDIES, AQUATIC ENVIRONMENT, ALASKA , OCS, MARINE ORGANISMS
1311 " BASELINE STUDIES, OCS, ENVIRONMENTAL EFFECTS, OIL TRANSPORT
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1313 " BIOLOGICAL EFFECTS, OCS, NOAA, *OCSEAP, *PROCEEDINGS
1372 " BIOLOGICAL EFFECTS, OIL SPILLS, MARINE MAMMALS, SCOTLAND, *SULLOM VOE, *SEALS
1374 " CONTINGENCY PLANNING, BIRDS, BIOLOGICAL EFFECTS, STATISTICS, NORTH SEA, SCOTLAND, *SULLOM VOE
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1380 " CRUDE OIL, CONCENTRATIONS, OIL FIELDS, ENVIRONMENTAL EFFECTS, MARINE ENVIRONMENT
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1186 " BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SKIMMERS, SINKING AGENTS, SORBENTS, IMCO, MANUALS
1187 " CONTINGENCY PLANNING, ONSHORE, POLLUTION CONTROL, EQUIPMENT, GUIDELINES
1189 " CONTINGENCY PLANNING, POLLUTION CONTROL, EQUIPMENT, UK, *APPLICATION METHODS
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1192 " CHRONIC EFFECTS, ACUTE EFFECTS, SPILL CLEANUP, TOXICITY, MARINE ORGANISMS, HABITATS
1197 " SPILL RESPONSE, ECONOMICS, POLLUTION CONTROL
1199 " BEHAVIOR, PERFORMANCE TESTING, SIMULATIONS, PHYSICAL ASPECTS
1200 " DESIGN-ENGINEERING, EQUIPMENT, US, USSR, EPA, PERFORMANCE TESTING, *OHMSETT FACILITY
1201 " TOXICITY, PERFORMANCE TESTING, SIMULATIONS, EQUIPMENT, ENVIRONMENTAL EFFECTS, GUIDELINES, *ASTM SYMPOSIUM
1205 " SPILL CLEANUP, IRELAND, *BETELGEUSE SPILL, *AERIAL APPLICATION

1210 DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, OIL-WATER SEPARATION, SKIMMERS, SORBENTS, FLOTATION, EQUIPMENT, SPREADING
1211 " DESIGN-ENGINEERING, SPILL CLEANUP, EQUIPMENT, *DISPERSANT APPLICATION
1220 " CONTINGENCY PLANNING, BEACH CLEANUP, GUIDELINES, SPILL CLEANUP, INTERTIDAL ZONE, SHORELINES
1225 " COST ANALYSIS, SIMULATIONS, EQUIPMENT, *AERIAL APPLICATION
1229 " ENVIRONMENTAL EFFECTS, SPILL RESPONSE
1236 " CONTINGENCY PLANNING, COASTAL WATERS, SPILL CLEANUP, POLLUTION CONTROL
1237 " CANADA, SPILL REMOVAL, PERFORMANCE TESTING, EQUIPMENT, *HOVERCRAFT SPRAYING
1239 " POLLUTION CONTROL, TOXICITY, PRODUCT INFORMATION, *APPLICATION METHODS, *SPILL CONTROL CHEMICALS
1240 " PERFORMANCE TESTING, SPILL REMOVAL, EQUIPMENT, *AERIAL SPRAYING
1255 " CANADA, ACUTE EFFECTS, TOXICITY, PERFORMANCE TESTING
1265 " FUEL OIL, ZOOPLANKTON, TOXICITY, MORTALITY
1276 " BIOASSAY, BEACHES, TOXICITY, MARINE ORGANISMS
1277 " BACTERIA, FUEL OIL, TOXICITY, MICROORGANISMS, *BACTERIOPLANKTON, *WHITE SEA
1288 " CRUSTACEANS, CRUDE OIL, WSF, TOXICITY, SUBLETHAL EFFECTS, *COPEPODS
1320 " TOXICITY, ENVIRONMENTAL EFFECTS, TORREY CANYON SPILL, UK, MARSHES, RIVERS, LAKES
1332 " SPILL CLEANUP, ENVIRONMENTAL EFFECTS, SHORELINES, MARINE ORGANISMS, TOXICITY, UK, GUIDELINES, TORREY CANYON SPILL
1344 " CRUDE OIL, BIODEGRADATION, MICROORGANISMS, HYDROCARBONS
1350 " BEHAVIOR, DISPERSION, PHYSICAL ASPECTS
1351 " BEHAVIOR, ATLANTIC OCEAN, OIL SLICKS, PHYSICAL ASPECTS, HYDROCARBONS
1141 DISPERSION, DETECTION, BIBLIOGRAPHIES, REMOTE SENSING, OIL SPILLS, FATE, ESTUARIES
1144 " DISPERSANTS, CONCENTRATIONS, CHEMICAL ANALYSIS, HYDROCARBONS
1297 " CHEMICAL EFFECTS, BEHAVIOR, SURFACTANTS, PHYSICAL ASPECTS
1350 " DISPERSANTS, BEHAVIOR, PHYSICAL ASPECTS
1352 " OIL SLICKS, HYDROCARBONS , EVAPORATION, MODELS
1353 " BEHAVIOR, OIL SLICKS, SEA SURFACE, MODELS
1367 " OIL SLICKS, SPREADING, SIMULATIONS, PREDICTIONS
1158 DISPOSAL , CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, HYDROCARBONS , WASTEWATERS
1371 " PETROLEUM PRODUCTS, FATE, INDUSTRIES, WATER QUALITY, SOLID WASTES
1417 " BIODEGRADATION, EMULSIONS, WASTEWATER TREATMENT
1421 " OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, SOLID WASTES
1426 " BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, GRAVITY SEPARATION, FLOTATION, SLUDGE
1432 " CRANKCASE OIL, WASTE OIL, RECYCLING
1439 " EMULSIONS, WASTEWATERS, FLOTATION, OIL-WATER SEPARATION
1443 " WASTE OIL, LAND FARMING, SLUDGE
1449 " ALASKA , WASTE OIL TREATMENT, ENVIRONMENTAL EFFECTS
1467 " BOOK REVIEW, REUSE, WASTEWATER TREATMENT, LAND FARMING, POLLUTION PREVENTION
1124 DISTRIBUTION, CONCENTRATIONS, BIRDS, HYDROCARBONS , MONITORING, MARSHES, SCOTLAND, *SULLOM VOE
1168 " SOURCE IDENTIFICATION, HYDROCARBONS , OIL TERMINALS, FATE, SEDIMENTS, SCOTLAND, *SULLOM VOE
1299 " CRUDE OIL, AMOCO CADIZ SPILL, PHYSICAL ASPECTS, PHYSICAL EFFECTS, MOVEMENT, FRANCE
1300 " CRUDE OIL, BEACHES, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, PHYSICAL ASPECTS, FRANCE
1301 " CRUDE OIL, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, PHYSICAL EFFECTS, FRANCE
1324 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BEACHES, AMOCO CADIZ SPILL, SPILL CLEANUP, REMOTE SENSING, FRANCE
1325 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL CLEANUP, NOAA, EPA, FRANCE
1333 " PAH, SOIL, FRESHWATER, SEAWATER, PLANTS
1338 " BIODEGRADATION, BACTERIA, HYDROCARBONS , ITALY
1348 " HYDROCARBONS , FATE, SEDIMENTATION, NARRAGANSETT BAY
1349 " BEACHES, TAR, FATE, SEDIMENTS, PHYSICAL ASPECTS
1355 " TAR, DRIFT, PACIFIC OCEAN
1359 " CONCENTRATIONS, PAH, FATE, SOIL, SEDIMENTS, *POLLUTANT TRANSPORT
1368 " CRUDE OIL, ADSORPTION, MOVEMENT, SIMULATIONS, SEDIMENTS, PUGET SOUND
1406 DOE, STORAGE, STRATEGIC PETROLEUM RESERVE, RISK ANALYSIS
1346 DRIFT, ARGO MERCHANT SPILL, MOVEMENT, SPILL TRAJECTORIES, MONITORING, *NEAR-BOTTOM TRANSPORT
1355 " DISTRIBUTION, TAR, PACIFIC OCEAN
1362 " BEHAVIOR, ARGO MERCHANT SPILL, MODELS, OIL SPILLS, MOVEMENT, PREDICTIONS, SEA SURFACE
1363 " ARGO MERCHANT SPILL, MODELS, PREDICTIONS, MOVEMENT, SEA SURFACE
1365 " ARGO MERCHANT SPILL, MOVEMENT, SPILL TRAJECTORIES, PREDICTIONS, SPILL RESPONSE
1373 DRILLING, TOXICITY, INVERTEBRATES, FISH, *DRILLING FLUIDS
1377 " OIL FIELDS, PRODUCTION, OIL INDUSTRY, EPA, REGULATIONS, *DRILLING MUDS
1379 " BIBLIOGRAPHIES, OFFSHORE, OIL WELLS, ENVIRONMENTAL EFFECTS, EQUIPMENT, LEGISLATION
1433 " WASTEWATER TREATMENT, POLLUTION PREVENTION, *HYDROCYCLONE
R097 " CORAL REEFS, TOXICITY, *DRILLING MUDS
R114 " DEVELOPMENT, ENVIRONMENTAL EFFECTS, OIL SHALE, MARINE ENVIRONMENT, PLATFORMS
R115 " BENTHOS, ENVIRONMENTAL EFFECTS, OFFSHORE, MARINE ORGANISMS, FOOD WEB, *DRILLING MUDS

1305 ECONOMIC EFFECTS, CONTAMINATION, IXTOC 1 BLOWOUT, FISHERIES, TEXAS, *SHRIMP INDUSTRY
1306 " COST ANALYSIS, BOOK REVIEW, BIBLIOGRAPHIES, ECONOMICS
1197 ECONOMICS, DISPERSANTS, SPILL RESPONSE, POLLUTION CONTROL
1306 " ECONOMIC EFFECTS, COST ANALYSIS, BOOK REVIEW, BIBLIOGRAPHIES
1416 " BIBLIOGRAPHIES, WASTEWATER TREATMENT, PETROCHEMICALS, OIL INDUSTRY, POLLUTION PREVENTION
1273 ECOSYSTEMS, BIBLIOGRAPHIES, ARCTIC, ANIMALS, PLANTS
1326 " CONTAMINATION, BIOLOGICAL EFFECTS, AQUATIC ENVIRONMENT, FATE
1370 " COLD CLIMATES, BIODEGRADATION, PAH, FATE, WEATHERING, ZOOPLANKTON, UPTAKE, SEDIMENTS
R117 " BIOASSAY, WASTEWATERS, ESTUARIES, TOXICITY, SUBLETHAL EFFECTS, *STAGHORN SCULPIN
1403 EIS, STORAGE, STRATEGIC PETROLEUM RESERVE, TEXAS
1404 " STORAGE, STRATEGIC PETROLEUM RESERVE, OIL TRANSPORT, LOUISIANA
1405 " STORAGE, STRATEGIC PETROLEUM RESERVE, LOUISIANA
1213 EMULSIFICATION, SPILL REMOVAL, PATENT
1295 EMULSIONS, CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, AMOCO CADIZ SPILL, WEATHERING, FRANCE
1417 " DISPOSAL , BIODEGRADATION, WASTEWATER TREATMENT
1420 " WASTEWATER TREATMENT, FILTRATION, REFINERIES
1429 " WASTEWATER TREATMENT, OIL REMOVAL, *ELECTROCOAGULATION
1439 " DISPOSAL , WASTEWATERS, FLOTATION, OIL-WATER SEPARATION
1450 " OIL-WATER SEPARATION, REGULATIONS
R093 " CHEMICAL ANALYSIS, BALLAST , SAMPLING, WASTEWATER TREATMENT, OIL TANKS
1201 ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, PERFORMANCE TESTING, SIMULATIONS, EQUIPMENT, GUIDELINES, *ASTM SYMPOSIUM
1229 " DISPERSANTS, SPILL RESPONSE
1238 " COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, MORTALITY, MARINE ORGANISMS, FISHERIES, FRANCE
1256 " BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, MARINE ORGANISMS, *PROCEEDINGS
1261. " COASTAL WATERS, BIRDS, NEW YORK
1284 " AMOCO CADIZ SPILL, MARINE ORGANISMS, FISHERIES, MORTALITY, FRANCE
1298 " FATE, TOXICITY, GROUNDWATER, SOIL
1309 " CRUDE OIL, OIL INDUSTRY, REFINING, PETROLEUM PRODUCTS, WASTEWATERS, WASHINGTON, PUGET SOUND
1311 " DEVELOPMENT, BASELINE STUDIES, OCS, OIL TRANSPORT
1312 " DEVELOPMENT, BASELINE STUDIES, OCS
1315 " CONTAMINATION, AMOCO CADIZ SPILL, OIL SPILLS, SPILL REMOVAL, FRANCE
1319 " BIOLOGICAL EFFECTS, BENTHOS, FLORIDA SPILL, FATE, INTERTIDAL ZONE, MARSHES, MARINE ORGANISMS, MASSACHUSETTS
1320 " DISPERSANTS,TOXICITY, TORREY CANYON SPILL, UK, MARSHES, RIVERS, LAKES
1322 " CRUDE OIL, BIOLOGICAL EFFECTS, PETROCHEMICALS, HEALTH HAZARDS, *BIOACCUMULATION
1323 " MOVEMENT, MONITORING, MARINE ENVIRONMENT, ESTUARIES, *PROCEEDINGS
1330 " OFFSHORE, PRODUCTION, MARINE ORGANISMS
1331 " OIL INDUSTRY, PETROCHEMICALS, FISHERIES, JAPAN, *SETO INLAND SEA
1332 " DISPERSANTS, SPILL CLEANUP, SHORELINES, MARINE ORGANISMS, TOXICITY, UK, GUIDELINES, TORREY CANYON SPILL
1334 " FOSSIL FUELS, INDUSTRIES
1366 " ARGO MERCHANT SPILL, RISK ANALYSIS, MODELS, PREDICTIONS, ONSHORE IMPACTS
1375 " DEVELOPMENT, OIL SHALE, HEALTH HAZARDS
1376 " PRODUCTION, OIL INDUSTRY, GROUNDWATER
1379 " DRILLING, BIBLIOGRAPHIES, OFFSHORE, OIL WELLS, EQUIPMENT, LEGISLATION
1380 " DEVELOPMENT, CRUDE OIL, CONCENTRATIONS, OIL FIELDS, MARINE ENVIRONMENT
1381 " OIL SHALE, *SURFACE TECHNOLOGY
1382 " COASTS, RESOURCE MANAGEMENT, OIL INDUSTRY
1383 " MODELS, OIL SPILLS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS, PUGET SOUND, OIL INDUSTRY
1391 " DEVELOPMENT, BIBLIOGRAPHIES, TANKERS, PORTS , OFFSHORE
1394 " TANKERS, SAFETY, POLLUTION PREVENTION, RISK ANALYSIS, OIL SPILLS, SEGREGATED BALLAST, USCG
1401 " COST ANALYSIS, STORAGE, STRATEGIC PETROLEUM RESERVE, LOUISIANA
1421 " DISPOSAL , OIL SHALE, EXTRACTION, SOLID WASTES
1438 " WASTEWATER TREATMENT, OIL INDUSTRY
1449 " DISPOSAL , ALASKA , WASTE OIL TREATMENT
R109 " BASELINE STUDIES, OFFSHORE, EXPLORATION, OCS, GEORGES BANK, RISK ANALYSIS
R111 " BIODEGRADATION, OIL SPILLS, MOLLUSKS, HYDROCARBONS , PREDICTIONS
R113 " DEVELOPMENT, MARINE ENVIRONMENT, FISHERIES, MEXICO , *TERMINOS LAGOON
R114 " DRILLING, DEVELOPMENT, OIL SHALE, MARINE ENVIRONMENT, PLATFORMS
R115 " DRILLING, BENTHOS, OFFSHORE, MARINE ORGANISMS, FOOD WEB, *DRILLING MUDS
1177 EPA, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PERFORMANCE TESTING, EQUIPMENT, *OHMSETT FACILITY
1182 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, US, USSR, *OHMSETT FACILITY
1200 " DISPERSANTS, DESIGN-ENGINEERING, EQUIPMENT, US, USSR, PERFORMANCE TESTING, *OHMSETT FACILITY

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1202 EPA, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, *OHMSETT FACILITY
1241 " CONTINGENCY PLANNING, BUZZARDS BAY, BOUCHARD 65 SPILL, BIOLOGICAL EFFECTS, SPILL CLEANUP, SPILL RESPONSE, FUEL OIL, SAMPLING
1325 " DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL CLEANUP, NOAA, FRANCE
1377 " DRILLING, OIL FIELDS, PRODUCTION, OIL INDUSTRY, REGULATIONS, *DRILLING MUDS
1469 " DESIGN-ENGINEERING, POLLUTION CONTROL, EQUIPMENT, PERFORMANCE TESTING, *OHMSETT FACILITY
1470 " DESIGN-ENGINEERING, PERFORMANCE TESTING, EQUIPMENT, *OHMSETT FACILITY
R090 " CHEMICAL ANALYSIS, WATER QUALITY, EQUIPMENT, SAMPLING
R096 " DEVELOPMENT, OIL SHALE, REGULATIONS, POLLUTION PREVENTION, GUIDELINES
1133 EQUIPMENT, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, PATENT, *VOLATILIZATION
1134 " DETECTION, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, PATENT
1138 " DESIGN-ENGINEERING, CHEMICAL ANALYSIS, MONITORING, WASTEWATER TREATMENT, RIVERS, INDIA
1142 " REMOTE SENSING, HYDROCARBONS , OIL SPILLS, MONITORING
1176 " SPILL CONTAINMENT, OIL SLICKS, SPREADING
1177 " EPA, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PERFORMANCE TESTING, *OHMSETT FACILITY
1178 " CONTINGENCY PLANNING, CANADA, BOOMS, PRODUCT INFORMATION, SPILL CONTAINMENT, PERFORMANCE TESTING, RIVERS, US
1179 " DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, SIMULATIONS
1180 " ABSORPTION, SORBENTS, POLLUTION PREVENTION, PATENT, *BILGES
1181 " DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PATENT
1184 " DISPERSANTS, DESIGN-ENGINEERING, PERFORMANCE TESTING, POLLUTION CONTROL
1187 " DISPERSANTS, CONTINGENCY PLANNING, ONSHORE, POLLUTION CONTROL, GUIDELINES
1189 " DISPERSANTS, CONTINGENCY PLANNING, POLLUTION CONTROL, UK, *APPLICATION METHODS
1193 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, OIL-WATER SEPARATION, PATENT
1198 " DESIGN-ENGINEERING, SPILL REMOVAL, PERFORMANCE TESTING, SKIMMERS
1200 " EPA, DISPERSANTS, DESIGN-ENGINEERING, US, USSR, PERFORMANCE TESTING, *OHMSETT FACILITY
1201 " ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, PERFORMANCE TESTING, SIMULATIONS, GUIDELINES, *ASTM SYMPOSIUM
1202 " EPA, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, *OHMSETT FACILITY
1203 " DESIGN-ENGINEERING, BOOMS, OIL REMOVAL, SKIMMERS, FILTRATION, GRAVITY SEPARATION, PATENT
1204 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PATENT
1207 " DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS, SHIPS, PATENT
1208 " DESIGN-ENGINEERING, SPILL CLEANUP, SPILL REMOVAL, SHIPS, PATENT
1209 " DESIGN-ENGINEERING, SPILL CLEANUP, OIL-WATER SEPARATION, SKIMMERS, SEA SURFACE, PATENT
1210 " DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, OIL-WATER SEPARATION, SKIMMERS, SORBENTS, FLOTATION, SPREADING
1211 " DISPERSANTS, DESIGN-ENGINEERING, SPILL CLEANUP, *DISPERSANT APPLICATION
1212 " DESIGN-ENGINEERING, SKIMMERS, SPILL CLEANUP, PERFORMANCE TESTING, *OHMSETT FACILITY
1214 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PATENT
1215 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, *OHMSETT FACILITY
1216 " DESIGN-ENGINEERING, SPILL CLEANUP, *SIRENE
1225 " DISPERSANTS, COST ANALYSIS, SIMULATIONS, *AERIAL APPLICATION
1237 " DISPERSANTS, CANADA, SPILL REMOVAL, PERFORMANCE TESTING, *HOVERCRAFT SPRAYING
1240 " DISPERSANTS, PERFORMANCE TESTING, SPILL REMOVAL, *AERIAL SPRAYING
1379 " ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES, OFFSHORE, OIL WELLS, LEGISLATION
1387 " DESIGN-ENGINEERING, TANKERS, SKIMMERS, SPILL CLEANUP, MODELS
1392 " TANKERS, POLLUTION PREVENTION, OIL TRANSPORT, OIL TRANSFER, MANUALS
1413 " DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT
1444 " DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
1451 " DESIGN-ENGINEERING,. OIL-WATER SEPARATION, GRAVITY SEPARATION, WASTEWATER TREATMENT
1453 " OIL-WATER SEPARATION, WASTEWATER TREATMENT
1455 " COALESCENCE, OIL-WATER SEPARATION, FILTRATION, PATENT
1456 " BIBLIOGRAPHIES, BALLAST , OIL-WATER SEPARATION, SPILL REMOVAL, POLLUTION CONTROL
1459 " DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATER TREATMENT
1460 " DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT, *GREASE
1461 " REUSE, WASTE OIL TREATMENT, RECYCLING, GASOLINE, EXTRACTION
1469 " EPA, DESIGN-ENGINEERING, POLLUTION CONTROL, PERFORMANCE TESTING, *OHMSETT FACILITY
1470 " EPA, DESIGN-ENGINEERING, PERFORMANCE TESTING, *OHMSETT FACILITY
R087 " DETECTION, WASTEWATERS, MONITORING, SAMPLING, WATER QUALITY
R088 " CHROMATOGRAPHY, MONITORING, WASTEWATERS, OIL INDUSTRY
R090 " EPA, CHEMICAL ANALYSIS, WATER QUALITY, SAMPLING
R092 " CHEMICAL ANALYSIS, OIL SPILLS, GC/MS
R095 " DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, *OHMSETT FACILITY
R118 " OIL-WATER SEPARATION, SPILL CLEANUP, STORAGE, USCG
1141 ESTUARIES, DISPERSION, DETECTION, BIBLIOGRAPHIES, REMOTE SENSING, OIL SPILLS, FATE

1323 ESTUARIES, ENVIRONMENTAL EFFECTS, MOVEMENT, MONITORING, MARINE ENVIRONMENT, *PROCEEDINGS
R117 " ECOSYSTEMS, BIOASSAY, WASTEWATERS, TOXICITY, SUBLETHAL EFFECTS, *STAGHORN SCULPIN
1464 EUROPE, CRANKCASE OIL, RECLAMATION, RECYCLING, WASTE OIL, LEGISLATION, US, GOVERNMENT AGENCIES
1352 EVAPORATION, DISPERSION, OIL SLICKS, HYDROCARBONS , MODELS
1354 " HYDROCARBONS , PHYSICAL ASPECTS, SOLUBILITY, *AIR-WATER INTERFACE, *HENRY'S LAW
R109 EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OFFSHORE, OCS, GEORGES BANK, RISK ANALYSIS
1125 EXTRACTION, DETECTION, ANALYTICAL TECHNIQUES, PAH, HYDROCARBONS , WASTEWATERS, REFINERIES, *FLUOROMETRY
1390 " TANKERS, OIL TRANSFER, POLLUTION PREVENTION
1421 " ENVIRONMENTAL EFFECTS, DISPOSAL , OIL SHALE, SOLID WASTES
1461 " EQUIPMENT, REUSE, WASTE OIL TREATMENT, RECYCLING, GASOLINE
1141 FATE, ESTUARIES, DISPERSION, DETECTION, BIBLIOGRAPHIES, REMOTE SENSING, OIL SPILLS
1168 " DISTRIBUTION, SOURCE IDENTIFICATION, HYDROCARBONS , OIL TERMINALS, SEDIMENTS, SCOTLAND, *SULLOM VOE
1244 " CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, HEALTH HAZARDS, MARINE ENVIRONMENT
1298 " ENVIRONMENTAL EFFECTS, TOXICITY, GROUNDWATER, SOIL
1316 " BIOLOGICAL EFFECTS, BIODEGRADATION, AQUATIC ENVIRONMENT, MOVEMENT
1319 " ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, FLORIDA SPILL, INTERTIDAL ZONE, MARSHES, MARINE ORGANISMS, MASSACHUSETTS
1326 " ECOSYSTEMS, CONTAMINATION, BIOLOGICAL EFFECTS, AQUATIC ENVIRONMENT
1329 " COLD CLIMATES, BOOK REVIEW, BIRDS, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, WEATHERING, FISH, *TRANSPORT
1348 " DISTRIBUTION, HYDROCARBONS , SEDIMENTATION, NARRAGANSETT BAY
1349 " DISTRIBUTION, BEACHES, TAR, SEDIMENTS, PHYSICAL ASPECTS
1359 " DISTRIBUTION, CONCENTRATIONS, PAH, SOIL, SEDIMENTS, *POLLUTANT TRANSPORT
1369 " CARIBBEAN SEA, BIOLOGICAL EFFECTS, NATURAL SEEPAGE, HYDROCARBONS , TEXAS, GULF OF MEXICO
1370 " ECOSYSTEMS, COLD CLIMATES, BIODEGRADATION, PAH, WEATHERING, ZOOPLANKTON, UPTAKE, SEDIMENTS
1371 " DISPOSAL , PETROLEUM PRODUCTS, INDUSTRIES, WATER QUALITY, SOLID WASTES
R112 " BEACHES, TAR, SOURCE IDENTIFICATION
1203 FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, OIL REMOVAL, SKIMMERS, GRAVITY SEPARATION, PATENT
1415 " BIOLOGICAL EFFECTS, WASTEWATER TREATMENT, OIL INDUSTRY, TOXICITY
1420 " EMULSIONS, WASTEWATER TREATMENT, REFINERIES
1423 " WASTEWATER TREATMENT, REFINERIES, OIL REMOVAL
1434 " WASTEWATER TREATMENT, OIL REMOVAL, SOLID WASTES, PATENT
1436 " DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL REMOVAL, GRAVITY SEPARATION, PATENT
1437 " WASTEWATER TREATMENT, OIL REMOVAL, GRAVITY SEPARATION, PATENT
1440 " WASTEWATER TREATMENT, REFINERIES
1454 " OIL-WATER SEPARATION, PATENT
1455 " EQUIPMENT, COALESCENCE, OIL-WATER SEPARATION, PATENT
R116 " WASTEWATER TREATMENT, REFINERIES, REUSE
1127 FISH, DETECTION, BIOINDICATORS, BIBLIOGRAPHIES, ANIMALS, MICROORGANISMS, PLANTS
1156 " CONTAMINATION, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, MOLLUSKS, *FREEZE DRYING
1159 " ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, HYDROCARBONS , SAMPLING, MARINE ORGANISMS, SEDIMENTS
1163 " CONTAMINATION, CONCENTRATIONS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, SURFACTANTS, JAPAN
1167 " CONTAMINATION, BIOLOGICAL EFFECTS, AUSTRALIA, SOURCE IDENTIFICATION
1246 " CONTAMINATION, BIOLOGICAL EFFECTS, HEALTH HAZARDS, *NECROSIS
1250 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, FOOD WEB, TOXICITY
1257 " CRUDE OIL, TOXICITY, *PLASMA, *COPPER
1266 " BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, METABOLISM, *LIVER, *GLUCOSE
1267 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, FUEL OIL, MORTALITY, REPRODUCTION
1270 " BIRDS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, TOXICITY, MARINE ORGANISMS, MOLLUSKS, ZOOPLANKTON, *DIESEL FUEL
1271 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION, MORTALITY, GROWTH, *CYTOGENETICS
1279 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, INVERTEBRATES, HYDROCARBONS , *MIXED-FUNCTION OXIDASE ACTIVITY
1285 " CRUSTACEANS, BIOLOGICAL EFFECTS, BASELINE STUDIES, ARGO MERCHANT SPILL, MOLLUSKS, *HISTOPATHOLOGY
1286 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, MORTALITY, ZOOPLANKTON, TOXICITY
1290 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, MOLLUSKS, SUBLETHAL EFFECTS
1308 " DEVELOPMENT, BASELINE STUDIES, ATLANTIC COAST, PAH, OCS, OFFSHORE
1329 " FATE, COLD CLIMATES, BOOK REVIEW, BIRDS, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, WEATHERING, *TRANSPORT
1373 " DRILLING, TOXICITY, INVERTEBRATES, *DRILLING FLUIDS
R086 " DETECTION, CARCINOGENS, BIOINDICATORS
R099 " CARCINOGENS, BIOLOGICAL EFFECTS
R100 " BIRDS, BIOLOGICAL EFFECTS, BEHAVIOR, TOXICITY

R102 FISH, CRUDE OIL, WSF, SUBLETHAL EFFECTS, RIVERS, SUBARCTIC REGIONS, *JUVENILE CHUM-SALMON
R104 " CARCINOGENS, BIOASSAY, TOXICITY, OIL SHALE, PETROLEUM PRODUCTS
R105 " CONTAMINATION, BIOLOGICAL EFFECTS, GROWTH, METABOLISM, *JUVENILE PINK SALMON
R107 " BIOLOGICAL EFFECTS, HYDROCARBONS , MOLLUSKS, *IMMUNE SYSTEM
1234 FISHERIES, COMPENSATION, LIABILITY, LEGISLATION, REGULATIONS, US
1238 " ENVIRONMENTAL EFFECTS, COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, MORTALITY, MARINE ORGANISMS, FRANCE
1243 " BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY, MARINE ORGANISMS
1253 " BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY, FRANCE
1254 " BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY, FRANCE
1284 " ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MARINE ORGANISMS, MORTALITY, FRANCE
1305 " ECONOMIC EFFECTS, CONTAMINATION, IXTOC 1 BLOWOUT, TEXAS, *SHRIMP INDUSTRY
1331 " ENVIRONMENTAL EFFECTS, OIL INDUSTRY, PETROCHEMICALS, JAPAN, *SETO INLAND SEA
1384 " DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, IMCO, OIL TRANSPORT, LEGISLATION, LAW ENFORCEMENT
R113 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, MARINE ENVIRONMENT, MEXICO , *TERMINOS LAGOON
1425 FLOCCULATION, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
1319 FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, INTERTIDAL ZONE, MARSHES, MARINE ORGANISMS, MASSACHUSETTS
1210 FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, OIL-WATER SEPARATION, SKIMMERS, SORBENTS, SPREADING
1426 " DISPOSAL , BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, GRAVITY SEPARATION, SLUDGE
1439 " EMULSIONS, DISPOSAL , WASTEWATERS, OIL-WATER SEPARATION
1458 " OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT
1250 FOOD WEB, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, TOXICITY
1274 " DEPURATION, CRUDE OIL, HYDROCARBONS , MOLLUSKS, UPTAKE
R115 " ENVIRONMENTAL EFFECTS, DRILLING, BENTHOS, OFFSHORE, MARINE ORGANISMS, *DRILLING MUDS
1334 FOSSIL FUELS, ENVIRONMENTAL EFFECTS, INDUSTRIES
1194 FRANCE, BEHAVIOR, AMOCO CADIZ SPILL, SPILL CLEANUP, PHYSICAL ASPECTS, POLLUTION CONTROL
1221 " CONTINGENCY PLANNING, COASTS, AMOCO CADIZ SPILL, SPILL CLEANUP, POLLUTION CONTROL
1238 " FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, MORTALITY, MARINE ORGANISMS
1253 " FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY
1254 " FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY
1263 " BIOLOGICAL EFFECTS, BENTHOS, AMOCO CADIZ SPILL, INVERTEBRATES, ONSHORE, TOXICITY
1284 " FISHERIES, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MARINE ORGANISMS, MORTALITY
1295 " EMULSIONS, CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, AMOCO CADIZ SPILL, WEATHERING
1296 " CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, AMOCO CADIZ SPILL, WEATHERING
1299 " DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, PHYSICAL ASPECTS, PHYSICAL EFFECTS, MOVEMENT
1300 " DISTRIBUTION, CRUDE OIL, BEACHES, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, PHYSICAL ASPECTS
1301 " DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, PHYSICAL EFFECTS
1315 " ENVIRONMENTAL EFFECTS, CONTAMINATION, AMOCO CADIZ SPILL, OIL SPILLS, SPILL REMOVAL
1324 " DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BEACHES, AMOCO CADIZ SPILL, SPILL CLEANUP, REMOTE SENSING
1325 " EPA, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL CLEANUP, NOAA
1117 FRESHWATER, CHEMICAL ANALYSIS, SAMPLING, SOILS, SEDIMENTS
1333 " DISTRIBUTION, PAH, SOIL, SEAWATER, PLANTS
1172 FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
1241 " EPA, CONTINGENCY PLANNING, BUZZARDS BAY, BOUCHARD 65 SPILL, BIOLOGICAL EFFECTS, SPILL CLEANUP, SPILL RESPONSE, SAMPLING
1247 " CRUDE OIL, AROMATIC HYDROCARBONS, ALGAE, WSF, TOXICITY, MICROORGANISMS
1248 " CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, MICROORGANISMS, PAH, TOXICITY
1265 " DISPERSANTS, ZOOPLANKTON, TOXICITY, MORTALITY
1267 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, MORTALITY, REPRODUCTION
1269 " OXIDATION, GC/MS, MICROORGANISMS, TOXICITY, *PHOTOOXIDATION
1277 " DISPERSANTS, BACTERIA, TOXICITY, MICROORGANISMS, *BACTERIOPLANKTON, *WHITE SEA
1289 " BIRDS, TOXICITY, MORTALITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY
1291 " BIOINDICATORS, ANALYTICAL TECHNIQUES, ALGAE, TOXICITY, INVERTEBRATES, *SPECIES DIVERSITY
R106 " CRUDE OIL, ALGAE, TOXICITY, REPRODUCTION, WATER QUALITY
1337 FUNGI, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS
1461 GASOLINE, EXTRACTION, EQUIPMENT, REUSE, WASTE OIL TREATMENT, RECYCLING
1169 GC/MS, DETECTION, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, HYDROCARBONS , SEDIMENTS, WEATHERING
1269 " FUEL OIL, OXIDATION, MICROORGANISMS, TOXICITY, *PHOTOOXIDATION
R092 " EQUIPMENT, CHEMICAL ANALYSIS, OIL SPILLS
1143 GEORGES BANK, CHROMATOGRAPHY, CHEMICAL ANALYSIS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, HYDROCARBONS
R109 " EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OFFSHORE, OCS, RISK ANALYSIS
1191 GOVERNMENT AGENCIES, DISPERSANTS, SPILL CLEANUP, POLLUTION CONTROL, REGULATIONS

1222 GOVERNMENT AGENCIES, CONTINGENCY PLANNING, LEGISLATION, SPILL RESPONSE
1235 " POLLUTION CONTROL, LEGISLATION, REGULATIONS, SPILL RESPONSE, LAW ENFORCEMENT
1242 " COMPENSATION, POLLUTION CONTROL, LEGISLATION, LIABILITY, UK
1464 " EUROPE, CRANKCASE OIL, RECLAMATION, RECYCLING, WASTE OIL, LEGISLATION, US
1203 GRAVITY SEPARATION, FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, OIL REMOVAL, SKIMMERS, PATENT
1426 " FLOTATION, DISPOSAL , BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, SLUDGE
1436 " FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
1437 " FILTRATION, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
1451 " EQUIPMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATER TREATMENT
1120 GREAT LAKES, CONTAMINATION, ANALYTICAL TECHNIQUES, MONITORING, WASTEWATERS, TOXICITY
1294 GROUNDWATER, SOIL, *VULNERABILITY, *BULGARIA
1298 " FATE, ENVIRONMENTAL EFFECTS, TOXICITY, SOIL
1360 " CONTAMINATION, MODELS, PETROLEUM PRODUCTS, MOVEMENT
1376 " ENVIRONMENTAL EFFECTS, PRODUCTION, OIL INDUSTRY
R108 " CONTAMINATION, CHROMATOGRAPHY, CHEMICAL EFFECTS, WSF, PHYSICAL EFFECTS
1260 GROWTH, DEVELOPMENT, CRUDE OIL, BIRDS, TOXICITY, MORTALITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY
1271 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION, MORTALITY, *CYTOGENETICS
1287 " BIOLOGICAL EFFECTS, PAH, METABOLISM, *CALLINECTES SAPIDUS
R103 " PAH, HYDROCARBONS , UPTAKE, TOXICITY, SUBLETHAL EFFECTS, INVERTEBRATES, *BIOACCUMULATION
R105 " FISH, CONTAMINATION, BIOLOGICAL EFFECTS, METABOLISM, *JUVENILE PINK SALMON
1197 GUIDELINES, EQUIPMENT, DISPERSANTS, CONTINGENCY PLANNING, ONSHORE, POLLUTION CONTROL
1201 " EQUIPMENT, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, PERFORMANCE TESTING, SIMULATIONS, *ASTM SYMPOSIUM
1220 " DISPERSANTS, CONTINGENCY PLANNING, BEACH CLEANUP, SPILL CLEANUP, INTERTIDAL ZONE, SHORELINES
1332 " ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, SHORELINES, MARINE ORGANISMS, TOXICITY, UK, TORREY CANYON SPILL
1468 " REUSE, WASTE OIL, RECYCLING, MANUALS
R096 " EPA, DEVELOPMENT, OIL SHALE, REGULATIONS, POLLUTION PREVENTION
1369 GULF OF MEXICO, FATE, CARIBBEAN SEA, BIOLOGICAL EFFECTS, NATURAL SEEPAGE, HYDROCARBONS , TEXAS
R110 " BASELINE STUDIES, ATLANTIC COAST, OCS, HYDROCARBONS , SEDIMENTS, *GEOCHEMISTRY
1192 HABITATS, DISPERSANTS, CHRONIC EFFECTS, ACUTE EFFECTS, SPILL CLEANUP, TOXICITY, MARINE ORGANISMS
R091 " COASTS, BENTHOS, SAMPLING, OIL SPILLS, MARINE ORGANISMS, SPILL RESPONSE, STATISTICAL ANALYSIS
1157 HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, HYDROCARBONS , SOURCE IDENTIFICATION, MARINE ORGANISMS, *TAIWAN
1244 HEALTH HAZARDS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, MARINE ENVIRONMENT
1246 " FISH, CONTAMINATION, BIOLOGICAL EFFECTS, *NECROSIS
1258 " CARCINOGENS, BIBLIOGRAPHIES, OIL INDUSTRY, PETROCHEMICALS, TOXICITY, REGULATIONS
1275 " CHRONIC EFFECTS, CARCINOGENS, BIOLOGICAL EFFECTS, PAH
1322 " ENVIRONMENTAL EFFECTS, CRUDE OIL, BIOLOGICAL EFFECTS, PETROCHEMICALS, *BIOACCUMULATION
1328 " BIBLIOGRAPHIES, SAFETY, TOXICITY, *DIESEL FUEL
1375 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, OIL SHALE
1124 HYDROCARBONS , DISTRIBUTION, CONCENTRATIONS, BIRDS, MONITORING, MARSHES, SCOTLAND, *SULLOM VOE
1125 " EXTRACTION, DETECTION, ANALYTICAL TECHNIQUES, PAH, WASTEWATERS, REFINERIES, *FLUOROMETRY
1126 " DETECTION, WASTEWATERS, *IR
1129 " DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES, SPECTROMETRY, SEAWATER
1133 " EQUIPMENT, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, SOIL, PATENT, *VOLATILIZATION
1134 " EQUIPMENT, DETECTION, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, SOIL, PATENT
1142 " EQUIPMENT, REMOTE SENSING, OIL SPILLS, MONITORING
1143 " GEORGES BANK, CHROMATOGRAPHY, CHEMICAL ANALYSIS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES
1144 " DISPERSION, DISPERSANTS, CONCENTRATIONS, CHEMICAL ANALYSIS
1146 " DETECTION, CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS, SAMPLING
1147 " BIOGENIC HYDROCARBONS, ANALYTICAL TECHNIQUES, WASTEWATERS, SEDIMENTS, MANUALS
1150 " CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SEDIMENTS, *TLC, *COLUMN CHROMATOGRAPHY
1154 " CHROMATOGRAPHY, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SEDIMENTS, MOVEMENT
1157 " HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, MARINE ORGANISMS, *TAIWAN
1158 " DISPOSAL , CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, WASTEWATERS
1159 " FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SAMPLING, MARINE ORGANISMS, SEDIMENTS
1160 " ANALYTICAL TECHNIQUES, WSF
1161 " CHEMICAL ANALYSIS, BEACHES, SOIL, SURFACTANTS

1168 HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, OIL TERMINALS, SEDIMENTS, SCOTLAND, *SULLOM VOE
1169 " GC/MS, DETECTION, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, SEDIMENTS, WEATHERING
1245 " DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, INTERTIDAL ZONE, SEDIMENTS, MARINE ORGANISMS, *RECRUITMENT
1259 " BIOLOGICAL EFFECTS, MOLLUSKS, RESOURCE MANAGEMENT, MASSACHUSETTS
1274 " FOOD WEB, DEPURATION, CRUDE OIL, MOLLUSKS, UPTAKE
1279 " FISH, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, INVERTEBRATES, *MIXED-FUNCTION OXIDASE ACTIVITY
1327 " DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES, SEDIMENTS
1336 " CRUDE OIL, CONCENTRATIONS, CHEMICAL ANALYSIS, BIODEGRADATION
1338 " DISTRIBUTION, BIODEGRADATION, BACTERIA, ITALY
1343 " BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS, MICROORGANISMS
1344 " DISPERSANTS, CRUDE OIL, BIODEGRADATION, MICROORGANISMS
1345 " BIODEGRADATION, BACTERIA, SHORELINES, SEDIMENTS, PUGET SOUND
1348 " FATE, DISTRIBUTION, SEDIMENTATION, NARRAGANSETT BAY
1351 " DISPERSANTS, BEHAVIOR, ATLANTIC OCEAN, OIL SLICKS, PHYSICAL ASPECTS
1352 " EVAPORATION, DISPERSION, OIL SLICKS, MODELS
1354 " EVAPORATION, PHYSICAL ASPECTS, SOLUBILITY, *AIR-WATER INTERFACE, *HENRY'S LAW
1356 " CRUDE OIL, CHEMICAL ANALYSIS, OXIDATION, SEAWATER
1369 " GULF OF MEXICO, FATE, CARIBBEAN SEA, BIOLOGICAL EFFECTS, NATURAL SEEPAGE, TEXAS
1431 " BIODEGRADATION, WASTE OIL TREATMENT, MICROORGANISMS, MODELS, *MYCOTORULA. *PSEUDOMONAS
R098 " CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR, NATURAL SEEPAGE
R103 " GROWTH, PAH, UPTAKE, TOXICITY, SUBLETHAL EFFECTS, INVERTEBRATES, *BIOACCUMULATION
R107 " FISH, BIOLOGICAL EFFECTS, MOLLUSKS, *IMMUNE SYSTEM
R110 " GULF OF MEXICO, BASELINE STUDIES, ATLANTIC COAST, OCS, SEDIMENTS, *GEOCHEMISTRY
R111 " ENVIRONMENTAL EFFECTS, BIODEGRADATION, OIL SPILLS, MOLLUSKS, PREDICTIONS
1226 ICE, CONTINGENCY PLANNING, COLD CLIMATES, SPILL RESPONSE, SPILL CLEANUP, USCG
1186 IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SKIMMERS, SINKING AGENTS, SORBENTS, MANUALS
1384 " FISHERIES, DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, OIL TRANSPORT, LEGISLATION, LAW ENFORCEMENT
1407 " INTERNATIONAL CONVENTIONS, TANKERS, OIL TERMINALS, POLLUTION CONTROL, LAW ENFORCEMENT, SPILL CLEANUP
1138 INDIA, EQUIPMENT, DESIGN-ENGINEERING, CHEMICAL ANALYSIS, MONITORING, WASTEWATER TREATMENT, RIVERS
1183 INDUSTRIES, SPILL CLEANUP, ONSHORE, WASTEWATERS, POLLUTION PREVENTION
1321 " BAYS, PETROLEUM PRODUCTS, POLLUTION CONTROL, *GREECE
1334 " FOSSIL FUELS, ENVIRONMENTAL EFFECTS
1371 " FATE, DISPOSAL , PETROLEUM PRODUCTS, WATER QUALITY, SOLID WASTES
1422 " WASTE OIL TREATMENT, RECLAMATION
1393 INFORMATION SYSTEMS, MODELS, TANKERS, SHIPS, OIL SPILLS, RISK ANALYSIS, USCG, *PIRS
1448 " WASTEWATERS, MANUALS
1231 INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, LEGISLATION, MARINE ENVIRONMENT, POLLUTION CONTROL
1397 INTERNATIONAL CONVENTIONS, BALLAST , TANKERS, OIL SPILLS, STATISTICS, OIL DISCHARGES, POLLUTION PREVENTION
1407 " IMCO, TANKERS, OIL TERMINALS, POLLUTION CONTROL, LAW ENFORCEMENT, SPILL CLEANUP
1220 INTERTIDAL ZONE, GUIDELINES, DISPERSANTS, CONTINGENCY PLANNING, BEACH CLEANUP, SPILL CLEANUP, SHORELINES
1245 " HYDROCARBONS , DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, SEDIMENTS, MARINE ORGANISMS, *RECRUITMENT
1319 " FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, MARSHES, MARINE ORGANISMS, MASSACHUSETTS
1218 INVERTEBRATES, CRUDE OIL, SPILL CLEANUP, MARSHES, RESTORATION, RECOVERY, SOIL, PLANTS
1252 " BIOASSAY, BENTHOS, REFINERIES, WASTEWATERS, TOXICITY
1263 " FRANCE, BIOLOGICAL EFFECTS, BENTHOS, AMOCO CADIZ SPILL, ONSHORE, TOXICITY
1279 " HYDROCARBONS , FISH, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, *MIXED-FUNCTION OXIDASE ACTIVITY
1291 " FUEL OIL, BIOINDICATORS, ANALYTICAL TECHNIQUES, ALGAE, TOXICITY, *SPECIES DIVERSITY
1373 " FISH, DRILLING, TOXICITY, *DRILLING FLUIDS
R101 " CARCINOGENS, PAH, MOLLUSKS, UPTAKE, SOURCES, OREGON
R103 " HYDROCARBONS , GROWTH, PAH, UPTAKE, TOXICITY, SUBLETHAL EFFECTS, *BIOACCUMULATION
1205 IRELAND, DISPERSANTS, SPILL CLEANUP, *BETELGEUSE SPILL, *AERIAL APPLICATION
1338 ITALY, HYDROCARBONS , DISTRIBUTION, BIODEGRADATION, BACTERIA
1305 IXTOC 1 BLOWOUT, FISHERIES, ECONOMIC EFFECTS, CONTAMINATION, TEXAS, *SHRIMP INDUSTRY
1152 JAPAN, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SAMPLING, TAR, SOURCE IDENTIFICATION
1163 " FISH, CONTAMINATION, CONCENTRATIONS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, SURFACTANTS
1175 " SPILL CONTAINMENT, POLLUTION CONTROL, SPILL RESPONSE, *GELATINIZATION AGENT
1331 " FISHERIES, ENVIRONMENTAL EFFECTS, OIL INDUSTRY, PETROCHEMICALS, *SETO INLAND SEA
1411 KUWAIT, COASTS, BALLAST , STATISTICS, OIL TRANSPORT, TANKERS, TAR, OIL SPILLS, POLLUTION CONTROL

1320 LAKES , ENVIRONMENTAL EFFECTS, DISPERSANTS,TOXICITY, TORREY CANYON SPILL, UK, MARSHES, RIVERS
1443 LAND FARMING, DISPOSAL , WASTE OIL, SLUDGE
1467 " DISPOSAL , BOOK REVIEW, REUSE, WASTEWATER TREATMENT, POLLUTION PREVENTION
1235 LAW ENFORCEMENT, GOVERNMENT AGENCIES, POLLUTION CONTROL, LEGISLATION, REGULATIONS, SPILL RESPONSE
1384 " IMCO, FISHERIES, DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, OIL TRANSPORT, LEGISLATION
1407 " INTERNATIONAL CONVENTIONS, IMCO, TANKERS, OIL TERMINALS, POLLUTION CONTROL, SPILL CLEANUP
1222 LEGISLATION, GOVERNMENT AGENCIES, CONTINGENCY PLANNING, SPILL RESPONSE
1231 " INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, MARINE ENVIRONMENT, POLLUTION CONTROL
1232 " COMPENSATION, US, LIABILITY, SPILL CLEANUP, *SUPERFUND
1233 " POLLUTION PREVENTION, RESOURCE MANAGEMENT, MISSISSIPPI
1234 " FISHERIES, COMPENSATION, LIABILITY, REGULATIONS, US
1235 " LAW ENFORCEMENT, GOVERNMENT AGENCIES, POLLUTION CONTROL, REGULATIONS, SPILL RESPONSE
1242 " GOVERNMENT AGENCIES, COMPENSATION, POLLUTION CONTROL, LIABILITY, UK
1314 " LIABILITY, REGULATIONS, *SUPERFUND
1379 " EQUIPMENT, ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES, OFFSHORE, OIL WELLS
1384 " LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, OIL TRANSPORT
1408 " BIOLOGICAL EFFECTS, OIL SPILLS, TANKERS, STATISTICS, UK
1464 " GOVERNMENT AGENCIES, EUROPE, CRANKCASE OIL, RECLAMATION, RECYCLING, WASTE OIL, US
1232 LIABILITY, LEGISLATION, COMPENSATION, US, SPILL CLEANUP, *SUPERFUND
1234 " LEGISLATION, FISHERIES, COMPENSATION, REGULATIONS, US
1242 " LEGISLATION, GOVERNMENT AGENCIES, COMPENSATION, POLLUTION CONTROL, UK
1314 " LEGISLATION, REGULATIONS, *SUPERFUND
1389 " OIL TRANSPORT, OIL TRANSFER, TANKERS, PORTS , OIL TERMINALS, SPILL CLEANUP, POLLUTION PREVENTION, REGULATIONS
1401 LOUISIANA, ENVIRONMENTAL EFFECTS, COST ANALYSIS, STORAGE, STRATEGIC PETROLEUM RESERVE
1404 " EIS, STORAGE, STRATEGIC PETROLEUM RESERVE, OIL TRANSPORT
1405 " EIS, STORAGE, STRATEGIC PETROLEUM RESERVE
1463 LUBRICATING OIL, REUSE, WASTE OIL, RECLAMATION, REFINING, PATENT
1147 MANUALS, HYDROCARBONS , BIOGENIC HYDROCARBONS, ANALYTICAL TECHNIQUES, WASTEWATERS, SEDIMENTS
1170 " DETECTION, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
1196 " IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SKIMMERS, SINKING AGENTS, SORBENTS
1392 " EQUIPMENT, TANKERS, POLLUTION PREVENTION, OIL TRANSPORT, OIL TRANSFER
1448 " INFORMATION SYSTEMS, WASTEWATERS
1468 " GUIDELINES, REUSE, WASTE OIL, RECYCLING
1231 MARINE ENVIRONMENT, LEGISLATION, INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, POLLUTION CONTROL
1244 " HEALTH HAZARDS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS
1323 " ESTUARIES, ENVIRONMENTAL EFFECTS, MOVEMENT, MONITORING, *PROCEEDINGS
1358 " ATLANTIC OCEAN, TAR, SEA SURFACE, WEATHERING, *SARGASSO SEA
1380 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, CRUDE OIL, CONCENTRATIONS, OIL FIELDS
R113 " FISHERIES, ENVIRONMENTAL EFFECTS, DEVELOPMENT, MEXICO , *TERMINOS LAGOON
R114 " ENVIRONMENTAL EFFECTS, DRILLING, DEVELOPMENT, OIL SHALE, PLATFORMS
1293 MARINE MAMMALS, CONTAMINATION, BIOLOGICAL EFFECTS, ANIMALS, TOXICITY, *SEA OTTER
1372 " DEVELOPMENT, BIOLOGICAL EFFECTS, OIL SPILLS, SCOTLAND, *SULLOM VOE, *SEALS
1131 MARINE ORGANISMS, BIOINDICATORS, *CHIRONOMUS
1157 " HYDROCARBONS , HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, *TAIWAN
1159 " HYDROCARBONS , FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SAMPLING, SEDIMENTS
1192 " HABITATS, DISPERSANTS, CHRONIC EFFECTS, ACUTE EFFECTS, SPILL CLEANUP, TOXICITY
1238 " FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, MORTALITY
1243 " FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY
1245 " INTERTIDAL ZONE, HYDROCARBONS , DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, SEDIMENTS, *RECRUITMENT
1251 " BIOLOGICAL EFFECTS, BENTHOS, ARGO MERCHANT SPILL, SUBLETHAL EFFECTS
1256 " ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, *PROCEEDINGS
1270 " FISH, BIRDS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, TOXICITY, MOLLUSKS, ZOOPLANKTON, *DIESEL FUEL
1272 " BEHAVIOR, PAH, METABOLISM
1276 " DISPERSANTS, BIOASSAY, BEACHES, TOXICITY
1282 " BIOLOGICAL EFFECTS, BENTHOS, ARGO MERCHANT SPILL
1284 " FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY
1310 " DEVELOPMENT, BASELINE STUDIES, AQUATIC ENVIRONMENT, ALASKA , OCS
1319 " INTERTIDAL ZONE, FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, MARSHES, MASSACHUSETTS
1330 " ENVIRONMENTAL EFFECTS, OFFSHORE, PRODUCTION

1332 MARINE ORGANISMS, GUIDELINES, ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, SHORELINES, TOXICITY, UK, TORREY CANYON SPILL
R091 " HABITATS, COASTS, BENTHOS, SAMPLING, OIL SPILLS, SPILL RESPONSE, STATISTICAL ANALYSIS
R115 " FOOD WEB, ENVIRONMENTAL EFFECTS, DRILLING, BENTHOS, OFFSHORE, *DRILLING MUDS
1124 MARSHES, HYDROCARBONS , DISTRIBUTION, CONCENTRATIONS, BIRDS, MONITORING, SCOTLAND, *SULLOM VOE
1218 " INVERTEBRATES, CRUDE OIL, SPILL CLEANUP, RESTORATION, RECOVERY, SOIL, PLANTS
1319 " MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, MASSACHUSETTS
1320 " LAKES , ENVIRONMENTAL EFFECTS, DISPERSANTS,TOXICITY, TORREY CANYON SPILL, UK, RIVERS
1165 MASSACHUSETTS, BEACHES, ARGO MERCHANT SPILL, SOURCE IDENTIFICATION, TAR, RHODE ISLAND
1259 " HYDROCARBONS , BIOLOGICAL EFFECTS, MOLLUSKS, RESOURCE MANAGEMENT
1319 " MARSHES, MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS
1396 " OIL SPILLS, TANKERS, *M/V CHESTER A. POLING
1266 METABOLISM, FISH, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, *LIVER, *GLUCOSE
1272 " MARINE ORGANISMS, BEHAVIOR, PAH
1287 " GROWTH, BIOLOGICAL EFFECTS, PAH, *CALLINECTES SAPIDUS
1341 " BIODEGRADATION, BACTERIA
R105 " GROWTH, FISH, CONTAMINATION, BIOLOGICAL EFFECTS, *JUVENILE PINK SALMON
R113 MEXICO , MARINE ENVIRONMENT, FISHERIES, ENVIRONMENTAL EFFECTS, DEVELOPMENT, *TERMINOS LAGOON
1127 MICROORGANISMS, FISH, DETECTION, BIOINDICATORS, BIBLIOGRAPHIES, ANIMALS, PLANTS
1247 " FUEL OIL, CRUDE OIL, AROMATIC HYDROCARBONS, ALGAE, WSF, TOXICITY
1248 " FUEL OIL, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, PAH, TOXICITY
1269 " GC/MS, FUEL OIL, OXIDATION, TOXICITY, *PHOTOOXIDATION
1277 " FUEL OIL, DISPERSANTS, BACTERIA, TOXICITY, *BACTERIOPLANKTON, *WHITE SEA
1335 " BIODEGRADATION, SOIL
1340 " CRUDE OIL, BIODEGRADATION, *VITAMINS
1342 " BIODEGRADATION, OIL REMOVAL, SPILL CLEANUP, PATENT
1343 " HYDROCARBONS , BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS
1344 " HYDROCARBONS , DISPERSANTS, CRUDE OIL, BIODEGRADATION
1431 " HYDROCARBONS , BIODEGRADATION, WASTE OIL TREATMENT, MODELS, *MYCOTORULA, *PSEUDOMONAS
1233 MISSISSIPPI, LEGISLATION, POLLUTION PREVENTION, RESOURCE MANAGEMENT
1395 MISSISSIPPI RIVER, TANKERS, OIL SPILLS, *ACCIDENT REPORT
1352 MODELS, HYDROCARBONS , EVAPORATION, DISPERSION, OIL SLICKS
1353 " DISPERSION, BEHAVIOR, OIL SLICKS, SEA SURFACE
1360 " GROUNDWATER, CONTAMINATION, PETROLEUM PRODUCTS, MOVEMENT
1361 " CRUDE OIL, CORAL REEFS, BIOLOGICAL EFFECTS, BACTERIA, SUBLETHAL EFFECTS
1362 " DRIFT, BEHAVIOR, ARGO MERCHANT SPILL, OIL SPILLS, MOVEMENT, PREDICTIONS, SEA SURFACE
1363 " DRIFT, ARGO MERCHANT SPILL, PREDICTIONS, MOVEMENT, SEA SURFACE
1364 " CALIFORNIA, PREDICTIONS, RISK ANALYSIS, SPILL TRAJECTORIES, OIL-GAS LEASING, SANTA BARBARA CHANNEL
1366 " ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, RISK ANALYSIS, PREDICTIONS, ONSHORE IMPACTS
1383 " ENVIRONMENTAL EFFECTS, OIL SPILLS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS, PUGET SOUND, OIL INDUSTRY
1387 " EQUIPMENT, DESIGN-ENGINEERING, TANKERS, SKIMMERS, SPILL CLEANUP
1393 " INFORMATION SYSTEMS, TANKERS, SHIPS, OIL SPILLS, RISK ANALYSIS, USCG, *PIRS
1399 " PIPELINES, SAFETY, POLLTION PREVENTION
1431 " MICROORGANISMS, HYDROCARBONS , BIODEGRADATION, WASTE OIL TREATMENT, *MYCOTORULA, *PSEUDOMONAS
1156 MOLLUSKS, FISH, CONTAMINATION, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, *FREEZE DRYING
1259 " MASSACHUSETTS, HYDROCARBONS , BIOLOGICAL EFFECTS, RESOURCE MANAGEMENT
1270 " MARINE ORGANISMS, FISH, BIRDS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, TOXICITY, ZOOPLANKTON, *DIESEL FUEL
1274 " HYDROCARBONS , FOOD WEB, DEPURATION, CRUDE OIL, UPTAKE
1278 " CONCENTRATIONS, CHEMICAL ANALYSIS, PAH, UPTAKE, *CLAMS
1285 " FISH, CRUSTACEANS, BIOLOGICAL EFFECTS, BASELINE STUDIES, ARGO MERCHANT SPILL, *HISTOPATHOLOGY
1290 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, SUBLETHAL EFFECTS
R101 " INVERTEBRATES, CARCINOGENS, PAH, UPTAKE, SOURCES, OREGON
R107 " HYDROCARBONS , FISH, BIOLOGICAL EFFECTS, *IMMUNE SYSTEM
R111 " HYDROCARBONS , ENVIRONMENTAL EFFECTS, BIODEGRADATION, OIL SPILLS, PREDICTIONS
1118 MONITORING, DETECTION, BIOINDICATORS, POLLUTION PREVENTION, *BIOMONITORING
1120 " GREAT LAKES, CONTAMINATION, ANALYTICAL TECHNIQUES, WASTEWATERS, TOXICITY
1124 " MARSHES, HYDROCARBONS , DISTRIBUTION, CONCENTRATIONS, BIRDS, SCOTLAND, *SULLOM VOE
1132 " BEHAVIOR, ARGO MERCHANT SPILL, OIL SLICKS, MOVEMENT
1138 " INDIA, EQUIPMENT, DESIGN-ENGINEERING, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, RIVERS
1142 " HYDROCARBONS , EQUIPMENT, REMOTE SENSING, OIL SPILLS

1292 MONITORING, BIOINDICATORS, REFINERIES, WASTEWATERS, SUBLETHAL EFFECTS, TOXICITY, *DAPHNIA
1323 " MARINE ENVIRONMENT, ESTUARIES, ENVIRONMENTAL EFFECTS, MOVEMENT, *PROCEEDINGS
1346 " DRIFT, ARGO MERCHANT SPILL, MOVEMENT, SPILL TRAJECTORIES, *NEAR-BOTTOM TRANSPORT
R087 " EQUIPMENT, DETECTION, WASTEWATERS, SAMPLING, WATER QUALITY
R088 " EQUIPMENT, CHROMATOGRAPHY, WASTEWATERS, OIL INDUSTRY
1238 MORTALITY, MARINE ORGANISMS, FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP
1243 " MARINE ORGANISMS, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL
1253 " FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES
1254 " FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES
1260 " GROWTH, DEVELOPMENT, CRUDE OIL, BIRDS, TOXICITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY
1264 " BIRDS, BIOLOGICAL EFFECTS, *VULNERABILITY INDEX
1265 " FUEL OIL, DISPERSANTS, ZOOPLANKTON, TOXICITY
1267 " FUEL OIL, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION
1271 " GROWTH, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION, *CYTOGENETICS
1281 " BIRDS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, TOXICITY
1284 " MARINE ORGANISMS, FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL
1286 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, ZOOPLANKTON, TOXICITY
1289 " FUEL OIL, BIRDS, TOXICITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY
1132 MOVEMENT, MONITORING, BEHAVIOR, ARGO MERCHANT SPILL, OIL SLICKS
1154 " HYDROCARBONS , CHROMATOGRAPHY, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SEDIMENTS
1299 " FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, PHYSICAL ASPECTS, PHYSICAL EFFECTS
1316 " FATE, BIOLOGICAL EFFECTS, BIODEGRADATION, AQUATIC ENVIRONMENT
1323 " MONITORING, MARINE ENVIRONMENT, ESTUARIES, ENVIRONMENTAL EFFECTS, *PROCEEDINGS
1346 " MONITORING, DRIFT, ARGO MERCHANT SPILL, SPILL TRAJECTORIES, *NEAR-BOTTOM TRANSPORT
1360 " MODELS, GROUNDWATER, CONTAMINATION, PETROLEUM PRODUCTS
1362 " MODELS, DRIFT, BEHAVIOR, ARGO MERCHANT SPILL, OIL SPILLS, PREDICTIONS, SEA SURFACE
1363 " MODELS, DRIFT, ARGO MERCHANT SPILL, PREDICTIONS, SEA SURFACE
1365 " DRIFT, ARGO MERCHANT SPILL, SPILL TRAJECTORIES, PREDICTIONS, SPILL RESPONSE
1368 " DISTRIBUTION, CRUDE OIL, ADSORPTION, SIMULATIONS, SEDIMENTS, PUGET SOUND
1123 MUTAGENS, DETECTION, CONTAMINATION, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES
1262 " CRUDE OIL, CHRONIC EFFECTS, TOXICITY
1268 " CRUDE OIL, BIOLOGICAL EFFECTS, BIOASSAY, TOXICITY
1348 NARRAGANSETT BAY, HYDROCARBONS , FATE, DISTRIBUTION, SEDIMENTATION
1171 NATURAL SEEPAGE, CALIFORNIA, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, TAR, *SANTA MONICA BAY, WEATHERING
1369 " HYDROCARBONS , GULF OF MEXICO, FATE, CARIBBEAN SEA, BIOLOGICAL EFFECTS, TEXAS
R098 " HYDROCARBONS , CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR
1162 NEW YORK, BAYS, ANALYTICAL TECHNIQUES, PAH, SPECTROSCOPY
1261 " ENVIRONMENTAL EFFECTS, COASTAL WATERS, BIRDS
1313 NOAA, DEVELOPMENT, BIOLOGICAL EFFECTS, OCS, *OCSEAP, *PROCEEDINGS
1325 " FRANCE, EPA, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL CLEANUP
1374 NORTH SEA, DEVELOPMENT, CONTINGENCY PLANNING, BIRDS, BIOLOGICAL EFFECTS, STATISTICS, SCOTLAND, *SULLOM VOE
1384 " LEGISLATION, LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, OFFSHORE, POLLUTION PREVENTION, OIL TRANSPORT
1304 OCS, DEVELOPMENT, SOCIOECONOMIC EFFECTS, OIL INDUSTRY
1308 " FISH, DEVELOPMENT, BASELINE STUDIES, ATLANTIC COAST, PAH, OFFSHORE
1310 " MARINE ORGANISMS, DEVELOPMENT, BASELINE STUDIES, AQUATIC ENVIRONMENT, ALASKA
1311 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, BASELINE STUDIES, OIL TRANSPORT
1312 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, BASELINE STUDIES
1313 " NOAA, DEVELOPMENT, BIOLOGICAL EFFECTS, *OCSEAP, *PROCEEDINGS
1385 " DEVELOPMENT, ATLANTIC OCEAN, OIL SPILLS, RISK ANALYSIS
1386 " DEVELOPMENT, CONTINGENCY PLANNING, PRODUCTION
R109 " GEORGES BANK, EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OFFSHORE, RISK ANALYSIS
R110 " HYDROCARBONS , GULF OF MEXICO, BASELINE STUDIES, ATLANTIC COAST, SEDIMENTS, *GEOCHEMISTRY
1307 OFFSHORE, DEVELOPMENT, BASELINE STUDIES, ALASKA , PRUDHOE BAY
1308 " OCS, FISH, DEVELOPMENT, BASELINE STUDIES, ATLANTIC COAST, PAH
1330 " MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, PRODUCTION
1378 " DEVELOPMENT, BASELINE STUDIES, OIL-GAS LEASING, OREGON
1379 " LEGISLATION, EQUIPMENT, ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES, OIL WELLS
1384 " NORTH SEA, LEGISLATION, LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, POLLUTION PREVENTION, OIL TRANSPORT
1391 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, BIBLIOGRAPHIES, TANKERS, PORTS
1398 " PIPELINES, SAFETY, POLLUTION PREVENTION, REGULATIONS
R109 " OCS, GEORGES BANK, EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, RISK ANALYSIS
R115 " MARINE ORGANISMS, FOOD WEB, ENVIRONMENTAL EFFECTS, DRILLING, BENTHOS, *DRILLING MUDS

1397 OIL DISCHARGES, INTERNATIONAL CONVENTIONS, BALLAST , TANKERS, OIL SPILLS, STATISTICS, POLLUTION PREVENTION
1445 " WASTEWATERS, TAR SANDS, RIVERS
R089 " CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, WASTEWATERS, POLLUTION CONTROL
1377 OIL FIELDS, EPA, DRILLING, PRODUCTION, OIL INDUSTRY, REGULATIONS, *DRILLING MUDS
1380 " MARINE ENVIRONMENT, ENVIRONMENTAL EFFECTS, DEVELOPMENT, CRUDE OIL, CONCENTRATIONS
1364 OIL-GAS LEASING, MODELS, CALIFORNIA, PREDICTIONS, RISK ANALYSIS, SPILL TRAJECTORIES, SANTA BARBARA CHANNEL
1378 " OFFSHORE, DEVELOPMENT, BASELINE STUDIES, OREGON
1258 OIL INDUSTRY, HEALTH HAZARDS, CARCINOGENS, BIBLIOGRAPHIES, PETROCHEMICALS, TOXICITY, REGULATIONS
1303 " SANTA BARBARA CHANNEL, OIL SPILLS, SOCIOECONOMIC EFFECTS, *TOURISM
1304 " OCS, DEVELOPMENT, SOCIOECONOMIC EFFECTS
1309 " ENVIRONMENTAL EFFECTS, CRUDE OIL, REFINING, PETROLEUM PRODUCTS, WASTEWATERS, WASHINGTON, PUGET SOUND
1331 " JAPAN, FISHERIES, ENVIRONMENTAL EFFECTS, PETROCHEMICALS, *SETO INLAND SEA
1376 " GROUNDWATER, ENVIRONMENTAL EFFECTS, PRODUCTION
1377 " OIL FIELDS, EPA, DRILLING, PRODUCTION, REGULATIONS, *DRILLING MUDS
1382 " ENVIRONMENTAL EFFECTS, COASTS, RESOURCE MANAGEMENT
1383 " MODELS, ENVIRONMENTAL EFFECTS, OIL SPILLS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS, PUGET SOUND
1414 " ADSORPTION, WASTEWATER TREATMENT, *PHENOL REMOVAL
1415 " FILTRATION, BIOLOGICAL EFFECTS, WASTEWATER TREATMENT, TOXICITY
1416 " ECONOMICS, BIBLIOGRAPHIES, WASTEWATER TREATMENT, PETROCHEMICALS, POLLUTION PREVENTION
1438 " ENVIRONMENTAL EFFECTS, WASTEWATER TREATMENT
R088 " MONITORING, EQUIPMENT, CHROMATOGRAPHY, WASTEWATERS
1195 OIL REMOVAL, SPILL CLEANUP, PATENT
1203 " GRAVITY SEPARATION, FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SKIMMERS, PATENT
1206 " ABSORPTION, SORBENTS, PATENT
1217 " ADSORPTION, SORBENTS, PATENT
1342 " MICROORGANISMS, BIODEGRADATION, SPILL CLEANUP, PATENT
1418 " DEMULSIFICATION, WASTEWATER TREATMENT, PATENT
1419 " WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES
1423 " FILTRATION, WASTEWATER TREATMENT, REFINERIES
1424 " WASTEWATER TREATMENT, PATENT
1425 " FLOCCULATION, WASTEWATER TREATMENT, PATENT
1427 " ADSORPTION, WASTEWATER TREATMENT, PERFORMANCE TESTING, *FOAM SEPARATION
1429 " EMULSIONS, WASTEWATER TREATMENT, *ELECTROCOAGULATION
1434 " FILTRATION, WASTEWATER TREATMENT, SOLID WASTES, PATENT
1436 " GRAVITY SEPARATION, FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT
1437 " GRAVITY SEPARATION, FILTRATION, WASTEWATER TREATMENT, PATENT
1442 " ADSORPTION, WASTEWATER TREATMENT, PATENT
1444 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT
1447 " WASTEWATER TREATMENT, PATENT
1375 OIL SHALE, HEALTH HAZARDS, ENVIRONMENTAL EFFECTS, DEVELOPMENT
1381 " ENVIRONMENTAL EFFECTS, *SURFACE TECHNOLOGY
1412 " WASTEWATERS, TAR SANDS
1421 " EXTRACTION, ENVIRONMENTAL EFFECTS, DISPOSAL , SOLID WASTES
R096 " GUIDELINES, EPA, DEVELOPMENT, REGULATIONS, POLLUTION PREVENTION
R104 " FISH, CARCINOGENS, BIOASSAY, TOXICITY, PETROLEUM PRODUCTS
R114 " MARINE ENVIRONMENT, ENVIRONMENTAL EFFECTS, DRILLING, DEVELOPMENT, PLATFORMS
1132 OIL SLICKS, MOVEMENT, MONITORING, BEHAVIOR, ARGO MERCHANT SPILL
1176 " EQUIPMENT, SPILL CONTAINMENT, SPREADING
1351 " HYDROCARBONS , DISPERSANTS, BEHAVIOR, ATLANTIC OCEAN, PHYSICAL ASPECTS
1352 " MODELS, HYDROCARBONS , EVAPORATION, DISPERSION
1353 " MODELS, DISPERSION, BEHAVIOR, SEA SURFACE
1357 " CONTAMINATION, BEHAVIOR, SPREADING
1367 " DISPERSION, SPREADING, SIMULATIONS, PREDICTIONS
1140 OIL SPILLS, DETECTION, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, SAMPLING, REMOTE SENSING, WASTEWATERS
1141 " FATE, ESTUARIES, DISPERSION, DETECTION, BIBLIOGRAPHIES, REMOTE SENSING
1142 " MONITORING, HYDROCARBONS , EQUIPMENT, REMOTE SENSING
1174 " ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
1223 " ARGO MERCHANT SPILL, PHYSICAL ASPECTS, SPILL RESPONSE, SPILL CLEANUP
1244 " MARINE ENVIRONMENT, HEALTH HAZARDS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS
1302 " ARGO MERCHANT SPILL, SOCIOECONOMIC EFFECTS
1303 " OIL INDUSTRY, SANTA BARBARA CHANNEL, SOCIOECONOMIC EFFECTS, *TOURISM
1315 " FRANCE, ENVIRONMENTAL EFFECTS, CONTAMINATION, AMOCO CADIZ SPILL, SPILL REMOVAL
1317 " BIRDS, BIOLOGICAL EFFECTS, SPILL RESPONSE, *CRISTOS BITAS SPILL
1318 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, PHYSICAL EFFECTS, SOCIOECONOMIC EFFECTS, *PROCEEDINGS
1339 " BIODEGRADATION, BIBLIOGRAPHIES, BACTERIA, ALGAE, SPILL CLEANUP
1362 " MOVEMENT, MODELS, DRIFT, BEHAVIOR, ARGO MERCHANT SPILL, PREDICTIONS, SEA SURFACE

1372 OIL SPILLS, MARINE MAMMALS, DEVELOPMENT, BIOLOGICAL EFFECTS, SCOTLAND, *SULLOM VOE, *SEALS
1383 " OIL INDUSTRY, MODELS, ENVIRONMENTAL EFFECTS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS, PUGET SOUND
1385 " OCS, DEVELOPMENT, ATLANTIC OCEAN, RISK ANALYSIS
1388 " OIL TRANSPORT, POLLUTION PREVENTION, *BARGES
1393 " MODELS, INFORMATION SYSTEMS, TANKERS, SHIPS, RISK ANALYSIS, USCG, *PIRS
1394 " ENVIRONMENTAL EFFECTS, TANKERS, SAFETY, POLLUTION PREVENTION, RISK ANALYSIS, SEGREGATED BALLAST, USCG
1395 " MISSISSIPPI RIVER, TANKERS, *ACCIDENT REPORT
1396 " MASSACHUSETTS, TANKERS, *M/V CHESTER A. POLING
1397 " OIL DISCHARGES, INTERNATIONAL CONVENTIONS, BALLAST , TANKERS, STATISTICS, POLLUTION PREVENTION
1408 " LEGISLATION, BIOLOGICAL EFFECTS, TANKERS, STATISTICS, UK
1411 " KUWAIT, COASTS, BALLAST , STATISTICS, OIL TRANSPORT, TANKERS, TAR, POLLUTION CONTROL
R091 " MARINE ORGANISMS, HABITATS, COASTS, BENTHOS, SAMPLING, SPILL RESPONSE, STATISTICAL ANALYSIS
R092 " GC/MS, EQUIPMENT, CHEMICAL ANALYSIS
R111 " MOLLUSKS, HYDROCARBONS , ENVIRONMENTAL EFFECTS, BIODEGRADATION, PREDICTIONS
R093 OIL TANKS, EMULSIONS, CHEMICAL ANALYSIS, BALLAST , SAMPLING, WASTEWATER TREATMENT
1168 OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, SEDIMENTS, SCOTLAND, *SULLOM VOE
1227 " CONTINGENCY PLANNING, POLLUTION PREVENTION, SPILL CLEANUP, SCOTLAND, *SULLOM VOE
1389 " LIABILITY, OIL TRANSPORT, OIL TRANSFER, TANKERS, PORTS , SPILL CLEANUP, POLLUTION PREVENTION, REGULATIONS
1400 " BIOLOGICAL EFFECTS, TANKERS, OIL TRANSFER, SCOTLAND, *SULLOM VOE
1407 " LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, IMCO, TANKERS, POLLUTION CONTROL, SPILL CLEANUP
1389 OIL TRANSFER, OIL TERMINALS, LIABILITY, OIL TRANSPORT, TANKERS, PORTS , SPILL CLEANUP, POLLUTION PREVENTION, REGULATIONS
1390 " EXTRACTION, TANKERS, POLLUTION PREVENTION
1392 " MANUALS, EQUIPMENT, TANKERS, POLLUTION PREVENTION, OIL TRANSPORT
1400 " OIL TERMINALS, BIOLOGICAL EFFECTS, TANKERS, SCOTLAND, *SULLOM VOE
1401 " DEEPWATER PORTS, POLLUTION PREVENTION, TANKERS, *TRANSFER CONTROL SYSTEMS
1311 OIL TRANSPORT, OCS, ENVIRONMENTAL EFFECTS, DEVELOPMENT, BASELINE STUDIES
1384 " OFFSHORE, NORTH SEA, LEGISLATION, LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, POLLUTION PREVENTION
1388 " OIL SPILLS, POLLUTION PREVENTION, *BARGES
1389 " OIL TRANSFER, OIL TERMINALS, LIABILITY, TANKERS, PORTS , SPILL CLEANUP, POLLUTION PREVENTION, REGULATIONS
1392 " OIL TRANSFER, MANUALS, EQUIPMENT, TANKERS, POLLUTION PREVENTION
1404 " LOUISIANA, EIS, STORAGE, STRATEGIC PETROLEUM RESERVE
1409 " DESIGN-ENGINEERING, PETROLEUM PRODUCTS, SAFETY, *TANK TRUCKS
1411 " OIL SPILLS, KUWAIT, COASTS, BALLAST , STATISTICS, TANKERS, TAR, POLLUTION CONTROL
1193 OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PATENT
1209 " EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, SEA SURFACE, PATENT
1210 " FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, SKIMMERS, SORBENTS, SPREADING
1413 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT
1419 " OIL REMOVAL, WASTEWATER TREATMENT, REFINERIES
1439 " FLOTATION, EMULSIONS, DISPOSAL , WASTEWATERS
1450 " EMULSIONS, REGULATIONS
1451 " GRAVITY SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT
1452 " ABSORPTION, *SORBENT FOAM
1453 " EQUIPMENT, WASTEWATER TREATMENT
1454 " FILTRATION, PATENT
1455 " FILTRATION, EQUIPMENT, COALESCENCE, PATENT
1456 " EQUIPMENT, BIBLIOGRAPHIES, BALLAST , SPILL REMOVAL, POLLUTION CONTROL
1457 " WASTEWATER TREATMENT, PATENT
1458 " FLOTATION, WASTEWATER TREATMENT, PATENT
1459 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT
1460 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT, *GREASE
R118 " EQUIPMENT, SPILL CLEANUP, STORAGE, USCG
1379 OIL WELLS, OFFSHORE, LEGISLATION, EQUIPMENT, ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES
1187 ONSHORE, GUIDELINES, EQUIPMENT, DISPERSANTS, CONTINGENCY PLANNING, POLLUTION CONTROL
1198 " INDUSTRIES, SPILL CLEANUP, WASTEWATERS, POLLUTION PREVENTION
1263 " INVERTEBRATES, FRANCE, BIOLOGICAL EFFECTS, BENTHOS, AMOCO CADIZ SPILL, TOXICITY
1366 ONSHORE IMPACTS, MODELS, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, RISK ANALYSIS, PREDICTIONS
1379 OREGON, OIL-GAS LEASING, OFFSHORE, DEVELOPMENT, BASELINE STUDIES
R101 " MOLLUSKS, INVERTEBRATES, CARCINOGENS, PAH, UPTAKE, SOURCES
1269 OXIDATION, MICROORGANISMS, GC/MS, FUEL OIL, TOXICITY, *PHOTOOXIDATION
1356 " HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, SEAWATER

1355 PACIFIC OCEAN, DRIFT, DISTRIBUTION, TAR
1125 PAH, HYDROCARBONS , EXTRACTION, DETECTION, ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, *FLUOROMETRY
1130 " ANALYTICAL TECHNIQUES, WASTEWATERS, *FLUOROMETRY
1135 " DETECTION, CONCENTRATIONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING
1139 " DETECTION, ANALYTICAL TECHNIQUES, *FLUORESCENCE
1148 " CHROMATOGRAPHY, ANALYTICAL TECHNIQUES
1162 " NEW YORK, BAYS, ANALYTICAL TECHNIQUES, SPECTROSCOPY
1248 " MICROORGANISMS, FUEL OIL, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, TOXICITY
1272 " METABOLISM, MARINE ORGANISMS, BEHAVIOR
1275 " HEALTH HAZARDS, CHRONIC EFFECTS, CARCINOGENS, BIOLOGICAL EFFECTS
1278 " MOLLUSKS, CONCENTRATIONS, CHEMICAL ANALYSIS, UPTAKE, *CLAMS
1287 " METABOLISM, GROWTH, BIOLOGICAL EFFECTS, *CALLINECTES SAPIDUS
1308 " OFFSHORE, OCS, FISH, DEVELOPMENT, BASELINE STUDIES, ATLANTIC COAST
1333 " FRESHWATER, DISTRIBUTION, SOIL, SEAWATER, PLANTS
1359 " FATE, DISTRIBUTION, CONCENTRATIONS, SOIL, SEDIMENTS, *POLLUTANT TRANSPORT
1370 " FATE, ECOSYSTEMS, COLD CLIMATES, BIODEGRADATION, WEATHERING, ZOOPLANKTON, UPTAKE, SEDIMENTS
R101 " OREGON, MOLLUSKS, INVERTEBRATES, CARCINOGENS, UPTAKE, SOURCES
R103 " INVERTEBRATES, HYDROCARBONS , GROWTH, UPTAKE, TOXICITY, SUBLETHAL EFFECTS, *BIOACCUMULATION
1119 PATENT, DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES, OIL-IN-WATER, *FLUORESCENCE
1133 " HYDROCARBONS , EQUIPMENT, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, SOIL, *VOLATILIZATION
1134 " HYDROCARBONS , EQUIPMENT, DETECTION, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, SOIL
1137 " DETECTION, CONCENTRATIONS, WASTEWATERS, TANKERS, *OPTICAL METHOD
1180 " EQUIPMENT, ABSORPTION, SORBENTS, POLLUTION PREVENTION, *BILGES
1181 " EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT
1183 " SPILL CLEANUP, SORBENTS
1185 " ABSORPTION, SORBENTS, PLANTS, *GRASS PEAT FIBERS
1193 " OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS
1195 " OIL REMOVAL, SPILL CLEANUP
1196 " ADSORPTION, SPILL CLEANUP, WASTEWATER TREATMENT, *POWDERED SHALE
1203 " OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SKIMMERS
1204 " EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS
1206 " OIL REMOVAL, ABSORPTION, SORBENTS
1207 " EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS, SHIPS
1208 " EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SPILL REMOVAL, SHIPS
1209 " OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, SEA SURFACE
1213 " EMULSIFICATION, SPILL REMOVAL
1214 " EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS
1217 " OIL REMOVAL, ADSORPTION, SORBENTS
1342 " OIL REMOVAL, MICROORGANISMS, BIODEGRADATION, SPILL CLEANUP
1413 " OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT
1418 " OIL REMOVAL, DEMULSIFICATION, WASTEWATER TREATMENT
1424 " OIL REMOVAL, WASTEWATER TREATMENT
1425 " OIL REMOVAL, FLOCCULATION, WASTEWATER TREATMENT
1434 " OIL REMOVAL, FILTRATION, WASTEWATER TREATMENT, SOLID WASTES
1435 " ADSORPTION, WASTEWATER TREATMENT, SORBENTS
1436 " OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT
1437 " OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, WASTEWATER TREATMENT
1441 " ACTIVATED SLUDGE, WASTEWATER TREATMENT
1442 " OIL REMOVAL, ADSORPTION, WASTEWATER TREATMENT
1444 " OIL REMOVAL, EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT
1446 " DEMULSIFICATION, WASTEWATER TREATMENT
1447 " OIL REMOVAL, WASTEWATER TREATMENT
1454 " OIL-WATER SEPARATION, FILTRATION
1455 " OIL-WATER SEPARATION, FILTRATION, EQUIPMENT, COALESCENCE
1457 " OIL-WATER SEPARATION, WASTEWATER TREATMENT
1458 " OIL-WATER SEPARATION, FLOTATION, WASTEWATER TREATMENT
1460 " OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, *GREASE
1462 " REUSE, WASTE OIL, RECLAMATION, REFINING
1463 " LUBRICATING OIL, REUSE, WASTE OIL, RECLAMATION, REFINING
1465 " REUSE, WASTE OIL, REFINING, RECLAMATION
1466 " REUSE, WASTE OIL TREATMENT
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1178 " EQUIPMENT, CONTINGENCY PLANNING, CANADA, BOOMS, PRODUCT INFORMATION, SPILL CONTAINMENT, RIVERS, US
1182 " EPA, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, US, USSR, *OHMSETT FACILITY
1184 " EQUIPMENT, DISPERSANTS, DESIGN-ENGINEERING, POLLUTION CONTROL

1198 PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, SPILL REMOVAL, SKIMMERS
1199 " DISPERSANTS, BEHAVIOR, SIMULATIONS, PHYSICAL ASPECTS
1200 " EQUIPMENT, EPA, DISPERSANTS, DESIGN-ENGINEERING, US, USSR, *OHMSETT FACILITY
1201 " GUIDELINES, EQUIPMENT, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, SIMULATIONS, *ASTM SYMPOSIUM
1202 " EQUIPMENT, EPA, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, *OHMSETT FACILITY
1212 " EQUIPMENT, DESIGN-ENGINEERING, SKIMMERS, SPILL CLEANUP, *OHMSETT FACILITY
1215 " EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, *OHMSETT FACILITY
1237 " EQUIPMENT, DISPERSANTS, CANADA, SPILL REMOVAL, *HOVERCRAFT SPRAYING
1240 " EQUIPMENT, DISPERSANTS, SPILL REMOVAL, *AERIAL SPRAYING
1255 " DISPERSANTS, CANADA, ACUTE EFFECTS, TOXICITY
1427 " OIL REMOVAL, ADSORPTION, WASTEWATER TREATMENT, *FOAM SEPARATION
1469 " EQUIPMENT, EPA, DESIGN-ENGINEERING, POLLUTION CONTROL, *OHMSETT FACILITY
1470 " EQUIPMENT, EPA, DESIGN-ENGINEERING, *OHMSETT FACILITY
1258 PETROCHEMICALS, OIL INDUSTRY, HEALTH HAZARDS, CARCINOGENS, BIBLIOGRAPHIES, TOXICITY, REGULATIONS
1322 " HEALTH HAZARDS, ENVIRONMENTAL EFFECTS, CRUDE OIL, BIOLOGICAL EFFECTS, *BIOACCUMULATION
1331 " OIL INDUSTRY, JAPAN, FISHERIES, ENVIRONMENTAL EFFECTS, *SETO INLAND SEA
1416 " OIL INDUSTRY, ECONOMICS, BIBLIOGRAPHIES, WASTEWATER TREATMENT, POLLUTION PREVENTION
1428 " BIBLIOGRAPHIES, ADSORPTION, WASTEWATER TREATMENT, REFINERIES, *ACTIVATED CARBON
1149 PETROLEUM PRODUCTS, CRUDE OIL, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
1151 " CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SAMPLING
1164 " ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
1266 " METABOLISM, FISH, BIOLOGICAL EFFECTS, *LIVER, *GLUCOSE
1309 " OIL INDUSTRY, ENVIRONMENTAL EFFECTS, CRUDE OIL, REFINING, WASTEWATERS, WASHINGTON, PUGET SOUND
1321 " INDUSTRIES, BAYS, POLLUTION CONTROL, *GREECE
1343 " MICROORGANISMS, HYDROCARBONS , BIODEGRADATION, BACTERIA
1360 " MOVEMENT, MODELS, GROUNDWATER, CONTAMINATION
1371 " INDUSTRIES, FATE, DISPOSAL , WATER QUALITY, SOLID WASTES
1409 " OIL TRANSPORT, DESIGN-ENGINEERING, SAFETY, *TANK TRUCKS
1430 " BIODEGRADATION, ANALYTICAL TECHNIQUES, WASTE OIL TREATMENT
R094 " DETECTION, CRUDE OIL, CHROMATOGRAPHY, SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, SEDIMENTS, *FINGERPRINTING
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1145 PHYSICAL ASPECTS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SAMPLING
1194 " FRANCE, BEHAVIOR, AMOCO CADIZ SPILL, SPILL CLEANUP, POLLUTION CONTROL
1199 " PERFORMANCE TESTING, DISPERSANTS, BEHAVIOR, SIMULATIONS
1223 " OIL SPILLS, ARGO MERCHANT SPILL, SPILL RESPONSE, SPILL CLEANUP
1297 " DISPERSION, CHEMICAL EFFECTS, BEHAVIOR, SURFACTANTS
1299 " MOVEMENT, FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, PHYSICAL EFFECTS
1300 " FRANCE, DISTRIBUTION, CRUDE OIL, BEACHES, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS
1349 " FATE, DISTRIBUTION, BEACHES, TAR, SEDIMENTS
1350 " DISPERSION, DISPERSANTS, BEHAVIOR
1351 " OIL SLICKS, HYDROCARBONS , DISPERSANTS, BEHAVIOR, ATLANTIC OCEAN
1354 " HYDROCARBONS , EVAPORATION, SOLUBILITY, *AIR-WATER INTERFACE, *HENRY'S LAW
1299 PHYSICAL EFFECTS, PHYSICAL ASPECTS, MOVEMENT, FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL
1301 " FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS
1318 " OIL SPILLS, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, SOCIOECONOMIC EFFECTS, *PROCEEDINGS
R108 " GROUNDWATER, CONTAMINATION, CHROMATOGRAPHY, CHEMICAL EFFECTS, WSF
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1399 " MODELS, SAFETY, POLLTION PREVENTION
1127 PLANTS, MICROORGANISMS, FISH, DETECTION, BIOINDICATORS, BIBLIOGRAPHIES, ANIMALS
1185 " PATENT, ABSORPTION, SORBENTS, *GRASS PEAT FIBERS
1218 " MARSHES, INVERTEBRATES, CRUDE OIL, SPILL CLEANUP, RESTORATION, RECOVERY, SOIL
1273 " ECOSYSTEMS, BIBLIOGRAPHIES, ARCTIC, ANIMALS
1333 " PAH, FRESHWATER, DISTRIBUTION, SOIL, SEAWATER
R114 PLATFORMS, OIL SHALE, MARINE ENVIRONMENT, ENVIRONMENTAL EFFECTS, DRILLING, DEVELOPMENT
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1184 " PERFORMANCE TESTING, EQUIPMENT, DISPERSANTS, DESIGN-ENGINEERING
1187 " ONSHORE, GUIDELINES, EQUIPMENT, DISPERSANTS, CONTINGENCY PLANNING
1189 " EQUIPMENT, DISPERSANTS, CONTINGENCY PLANNING, UK, *APPLICATION METHODS
1191 " GOVERNMENT AGENCIES, DISPERSANTS, SPILL CLEANUP, REGULATIONS
1194 " PHYSICAL ASPECTS, FRANCE, BEHAVIOR, AMOCO CADIZ SPILL, SPILL CLEANUP
1197 " ECONOMICS, DISPERSANTS, SPILL RESPONSE
1221 " FRANCE, CONTINGENCY PLANNING, COASTS, AMOCO CADIZ SPILL, SPILL CLEANUP
1224 " CONTINGENCY PLANNING, *MARICULTURE PROJECTS
1231 " MARINE ENVIRONMENT, LEGISLATION, INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES
1235 " LEGISLATION, LAW ENFORCEMENT, GOVERNMENT AGENCIES, REGULATIONS, SPILL RESPONSE
1236 " DISPERSANTS, CONTINGENCY PLANNING, COASTAL WATERS, SPILL CLEANUP

1239 POLLUTION CONTROL, DISPERSANTS, TOXICITY, PRODUCT INFORMATION, *APPLICATION METHODS, *SPILL CONTROL CHEMICALS
1242 " LIABILITY, LEGISLATION, GOVERNMENT AGENCIES, COMPENSATION, UK
1321 " PETROLEUM PRODUCTS, INDUSTRIES, BAYS, *GREECE
1407 " OIL TERMINALS, LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, IMCO, TANKERS, SPILL CLEANUP
1411 " OIL TRANSPORT, OIL SPILLS, KUWAIT, COASTS, BALLAST , STATISTICS, TANKERS, TAR
1456 " OIL-WATER SEPARATION, EQUIPMENT, BIBLIOGRAPHIES, BALLAST , SPILL REMOVAL
1469 " PERFORMANCE TESTING, EQUIPMENT, EPA, DESIGN-ENGINEERING, *OHMSETT FACILITY
R089 " OIL DISCHARGES, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, WASTEWATERS
1118 POLLUTION PREVENTION, MONITORING, DETECTION, BIOINDICATORS, *BIOMONITORING
1180 " PATENT, EQUIPMENT, ABSORPTION, SORBENTS, *BILGES
1188 " ONSHORE, INDUSTRIES, SPILL CLEANUP, WASTEWATERS
1227 " OIL TERMINALS, CONTINGENCY PLANNING, SPILL CLEANUP, SCOTLAND, *SULLOM VOE
1230 " CONTINGENCY PLANNING, BEAUFORT SEA, ARCTIC, SPILL RESPONSE, SPILL CLEANUP, SHORELINES
1233 " MISSISSIPPI, LEGISLATION, RESOURCE MANAGEMENT
1384 " OIL TRANSPORT, OFFSHORE, NORTH SEA, LEGISLATION, LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT
1388 " OIL TRANSPORT, OIL SPILLS, *BARGES
1389 " OIL TRANSPORT, OIL TRANSFER, OIL TERMINALS, LIABILITY, TANKERS, PORTS , SPILL CLEANUP, REGULATIONS
1390 " OIL TRANSFER, EXTRACTION, TANKERS
1392 " OIL TRANSPORT, OIL TRANSFER, MANUALS, EQUIPMENT, TANKERS
1394 " OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS, SAFETY, RISK ANALYSIS, SEGREGATED BALLAST, USCG
1397 " OIL SPILLS, OIL DISCHARGES, INTERNATIONAL CONVENTIONS, BALLAST , TANKERS, STATISTICS
1399 " PIPELINES, OFFSHORE, SAFETY, REGULATIONS
1401 " OIL TRANSFER, DEEPWATER PORTS, TANKERS, *TRANSFER CONTROL SYSTEMS
1410 " DEEPWATER PORTS, REGULATIONS, *OIL TRANSFER SYSTEM
1416 " PETROCHEMICALS, OIL INDUSTRY, ECONOMICS, BIBLIOGRAPHIES, WASTEWATER TREATMENT
1433 " DRILLING, WASTEWATER TREATMENT, *HYDROCYCLONE
1467 " LAND FARMING, DISPOSAL , BOOK REVIEW, REUSE, WASTEWATER TREATMENT
R096 " OIL SHALE, GUIDELINES, EPA, DEVELOPMENT, REGULATIONS
1389 PORTS , POLLUTION PREVENTION, OIL TRANSPORT, OIL TRANSFER, OIL TERMINALS, LIABILITY, TANKERS, SPILL CLEANUP, REGULATIONS
1391 " OFFSHORE, ENVIRONMENTAL EFFECTS, DEVELOPMENT, BIBLIOGRAPHIES, TANKERS
1362 PREDICTIONS, OIL SPILLS, MOVEMENT, MODELS, DRIFT, BEHAVIOR, ARGO MERCHANT SPILL, SEA SURFACE
1363 " MOVEMENT, MODELS, DRIFT, ARGO MERCHANT SPILL, SEA SURFACE
1364 " OIL-GAS LEASING, MODELS, CALIFORNIA, RISK ANALYSIS, SPILL TRAJECTORIES, SANTA BARBARA CHANNEL
1365 " MOVEMENT, DRIFT, ARGO MERCHANT SPILL, SPILL TRAJECTORIES, SPILL RESPONSE
1366 " ONSHORE IMPACTS, MODELS, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, RISK ANALYSIS
1367 " OIL SLICKS, DISPERSION, SPREADING, SIMULATIONS
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1178 PRODUCT INFORMATION, PERFORMANCE TESTING, EQUIPMENT, CONTINGENCY PLANNING, CANADA, BOOMS, SPILL CONTAINMENT, RIVERS, US .
1239 " POLLUTION CONTROL, DISPERSANTS, TOXICITY, *APPLICATION METHODS, *SPILL CONTROL CHEMICALS
1330 PRODUCTION, OFFSHORE, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS
1376 " OIL INDUSTRY, GROUNDWATER, ENVIRONMENTAL EFFECTS
1377 " OIL INDUSTRY, OIL FIELDS, EPA, DRILLING, REGULATIONS, *DRILLING MUDS
1386 " OCS, DEVELOPMENT, CONTINGENCY PLANNING
1307 PRUDHOE BAY, OFFSHORE, DEVELOPMENT, BASELINE STUDIES, ALASKA
1309 PUGET SOUND, PETROLEUM PRODUCTS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, CRUDE OIL, REFINING, WASTEWATERS, WASHINGTON
1345 " HYDROCARBONS , BIODEGRADATION, BACTERIA, SHORELINES, SEDIMENTS
1368 " MOVEMENT, DISTRIBUTION, CRUDE OIL, ADSORPTION, SIMULATIONS, SEDIMENTS
1383 " OIL SPILLS, OIL INDUSTRY, MODELS, ENVIRONMENTAL EFFECTS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS
1422 RECLAMATION, INDUSTRIES, WASTE OIL TREATMENT
1462 " PATENT, REUSE, WASTE OIL, REFINING
1463 " PATENT, LUBRICATING OIL, REUSE, WASTE OIL, REFINING
1464 " LEGISLATION, GOVERNMENT AGENCIES, EUROPE, CRANKCASE OIL, RECYCLING, WASTE OIL, US
1465 " PATENT, REUSE, WASTE OIL, REFINING
1218 RECOVERY, PLANTS, MARSHES, INVERTEBRATES, CRUDE OIL, SPILL CLEANUP, RESTORATION, SOIL
1432 RECYCLING, DISPOSAL , CRANKCASE OIL, WASTE OIL
1461 " GASOLINE, EXTRACTION, EQUIPMENT, REUSE, WASTE OIL TREATMENT
1464 " RECLAMATION, LEGISLATION, GOVERNMENT AGENCIES, EUROPE, CRANKCASE OIL, WASTE OIL, US
1468 " MANUALS, GUIDELINES, REUSE, WASTE OIL
1125 REFINERIES, PAH, HYDROCARBONS , EXTRACTION, DETECTION, ANALYTICAL TECHNIQUES, WASTEWATERS, *FLUOROMETRY
1252 " INVERTEBRATES, BIOASSAY, BENTHOS, WASTEWATERS, TOXICITY

1292 REFINERIES, MONITORING, BIOINDICATORS, WASTEWATERS, SUBLETHAL EFFECTS, TOXICITY, *DAPHNIA
1419 " OIL-WATER SEPARATION, OIL REMOVAL, WASTEWATER TREATMENT
1420 " FILTRATION, EMULSIONS, WASTEWATER TREATMENT
1423 " OIL REMOVAL, FILTRATION, WASTEWATER TREATMENT
1428 " PETROCHEMICALS, BIBLIOGRAPHIES, ADSORPTION, WASTEWATER TREATMENT, *ACTIVATED CARBON
1440 " FILTRATION, WASTEWATER TREATMENT
R116 " FILTRATION, WASTEWATER TREATMENT, REUSE
1309 REFINING, PUGET SOUND, PETROLEUM PRODUCTS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, CRUDE OIL, WASTEWATERS, WASHINGTON
1462 " RECLAMATION, PATENT, REUSE, WASTE OIL
1463 " RECLAMATION, PATENT, LUBRICATING OIL, REUSE, WASTE OIL
1465 " RECLAMATION, PATENT, REUSE, WASTE OIL
1191 REGULATIONS, POLLUTION CONTROL, GOVERNMENT AGENCIES, DISPERSANTS, SPILL CLEANUP
1234 " LIABILITY, LEGISLATION, FISHERIES, COMPENSATION, US
1235 " POLLUTION CONTROL, LEGISLATION, LAW ENFORCEMENT, GOVERNMENT AGENCIES, SPILL RESPONSE
1258 " PETROCHEMICALS, OIL INDUSTRY, HEALTH HAZARDS, CARCINOGENS, BIBLIOGRAPHIES, TOXICITY
1314 " LIABILITY, LEGISLATION, *SUPERFUND
1377 " PRODUCTION, OIL INDUSTRY, OIL FIELDS, EPA, DRILLING, *DRILLING MUDS
1389 " PORTS , POLLUTION PREVENTION, OIL TRANSPORT, OIL TRANSFER, OIL TERMINALS, LIABILITY, TANKERS, SPILL CLEANUP
1398 " POLLUTION PREVENTION, PIPELINES, OFFSHORE, SAFETY
1410 " POLLUTION PREVENTION, DEEPWATER PORTS, *OIL TRANSFER SYSTEM
1450 " OIL-WATER SEPARATION, EMULSIONS
R096 " POLLUTION PREVENTION, OIL SHALE, GUIDELINES, EPA, DEVELOPMENT
1140 REMOTE SENSING, OIL SPILLS, DETECTION, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, SAMPLING, WASTEWATERS
1141 " OIL SPILLS, FATE, ESTUARIES, DISPERSION, DETECTION, BIBLIOGRAPHIES
1142 " OIL SPILLS, MONITORING, HYDROCARBONS , EQUIPMENT
1324 " FRANCE, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BEACHES, AMOCO CADIZ SPILL, SPILL CLEANUP
1267 REPRODUCTION, MORTALITY, FUEL OIL, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL
1271 " MORTALITY, GROWTH, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, *CYTOGENETICS
R106 " FUEL OIL, CRUDE OIL, ALGAE, TOXICITY, WATER QUALITY
1233 RESOURCE MANAGEMENT, POLLUTION PREVENTION, MISSISSIPPI, LEGISLATION
1259 " MOLLUSKS, MASSACHUSETTS, HYDROCARBONS , BIOLOGICAL EFFECTS
1382 " OIL INDUSTRY, ENVIRONMENTAL EFFECTS, COASTS
1383 " PUGET SOUND, OIL SPILLS, OIL INDUSTRY, MODELS, ENVIRONMENTAL EFFECTS, SOCIOECONOMIC EFFECTS, RISK ANALYSIS
1218 RESTORATION, RECOVERY, PLANTS, MARSHES, INVERTEBRATES, CRUDE OIL, SPILL CLEANUP, SOIL
1461 REUSE, RECYCLING, GASOLINE, EXTRACTION, EQUIPMENT, WASTE OIL TREATMENT
1462 " REFINING, RECLAMATION, PATENT, WASTE OIL
1463 " REFINING, RECLAMATION, PATENT, LUBRICATING OIL, WASTE OIL
1465 " REFINING, RECLAMATION, PATENT, WASTE OIL
1466 " PATENT, WASTE OIL TREATMENT
1467 " POLLUTION PREVENTION, LAND FARMING, DISPOSAL , BOOK REVIEW, WASTEWATER TREATMENT
1468 " RECYCLING, MANUALS, GUIDELINES, WASTE OIL
R116 " REFINERIES, FILTRATION, WASTEWATER TREATMENT
1165 RHODE ISLAND, MASSACHUSETTS, BEACHES, ARGO MERCHANT SPILL, SOURCE IDENTIFICATION, TAR
1364 RISK ANALYSIS, PREDICTIONS, OIL-GAS LEASING, MODELS, CALIFORNIA, SPILL TRAJECTORIES, SANTA BARBARA CHANNEL
1366 " PREDICTIONS, ONSHORE IMPACTS, MODELS, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL
1383 " RESOURCE MANAGEMENT, PUGET SOUND, OIL SPILLS, OIL INDUSTRY, MODELS, ENVIRONMENTAL EFFECTS, SOCIOECONOMIC EFFECTS
1385 " OIL SPILLS, OCS, DEVELOPMENT, ATLANTIC OCEAN
1393 " OIL SPILLS, MODELS, INFORMATION SYSTEMS, TANKERS, SHIPS, USCG, *PIRS
1394 " POLLUTION PREVENTION, OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS, SAFETY, SEGREGATED BALLAST, USCG
1406 " DOE, STORAGE, STRATEGIC PETROLEUM RESERVE
R109 " OFFSHORE, OCS, GEORGES BANK, EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES
1138 RIVERS, MONITORING, INDIA, EQUIPMENT, DESIGN-ENGINEERING, CHEMICAL ANALYSIS, WASTEWATER TREATMENT
1178 " PRODUCT INFORMATION, PERFORMANCE TESTING, EQUIPMENT, CONTINGENCY PLANNING, CANADA, BOOMS, SPILL CONTAINMENT, US
1320 " MARSHES, LAKES , ENVIRONMENTAL EFFECTS, DISPERSANTS,TOXICITY, TORREY CANYON SPILL, UK
1445 " OIL DISCHARGES, WASTEWATERS, TAR SANDS
R102 " FISH, CRUDE OIL, WSF, SUBLETHAL EFFECTS, SUBARCTIC REGIONS, *JUVENILE CHUM-SALMON
1328 SAFETY, HEALTH HAZARDS, BIBLIOGRAPHIES, TOXICITY, *DIESEL FUEL
1394 " RISK ANALYSIS, POLLUTION PREVENTION, OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS, SEGREGATED BALLAST, USCG
1398 " REGULATIONS, POLLUTION PREVENTION, PIPELINES, OFFSHORE
1399 " PIPELINES, MODELS, POLLTION PREVENTION

1409 SAFETY, PETROLEUM PRODUCTS, OIL TRANSPORT, DESIGN-ENGINEERING, *TANK TRUCKS
1117 SAMPLING, FRESHWATER, CHEMICAL ANALYSIS, SOILS, SEDIMENTS
1135 " PAH, DETECTION, CONCENTRATIONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS
1136 " DETECTION, CONCENTRATIONS, WASTE OIL
1140 " REMOTE SENSING, OIL SPILLS, DETECTION, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, WASTEWATERS
1145 " PHYSICAL ASPECTS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES
1146 " HYDROCARBONS , DETECTION, CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS
1151 " PETROLEUM PRODUCTS, CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES
1152 " JAPAN, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, TAR, SOURCE IDENTIFICATION
1153 " CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, WEATHERING
1155 " CONCENTRATIONS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, WSF, *FLUORESCENCE SPECTROSCOPY
1159 " MARINE ORGANISMS, HYDROCARBONS , FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SEDIMENTS
1241 " FUEL OIL, EPA, CONTINGENCY PLANNING, BUZZARDS BAY, BOUCHARD 65 SPILL, BIOLOGICAL EFFECTS, SPILL CLEANUP, SPILL RESPONSE
R087 " MONITORING, EQUIPMENT, DETECTION, WASTEWATERS, WATER QUALITY
R090 " EQUIPMENT, EPA, CHEMICAL ANALYSIS, WATER QUALITY
R091 " OIL SPILLS, MARINE ORGANISMS, HABITATS, COASTS, BENTHOS, SPILL RESPONSE, STATISTICAL ANALYSIS
R093 " OIL TANKS, EMULSIONS, CHEMICAL ANALYSIS, BALLAST , WASTEWATER TREATMENT
1303 SANTA BARBARA CHANNEL, OIL SPILLS, OIL INDUSTRY, SOCIOECONOMIC EFFECTS, *TOURISM
1364 " RISK ANALYSIS, PREDICTIONS, OIL-GAS LEASING, MODELS, CALIFORNIA, SPILL TRAJECTORIES
1124 SCOTLAND, MONITORING, MARSHES, HYDROCARBONS , DISTRIBUTION, CONCENTRATIONS, BIRDS, *SULLOM VOE
1168 " OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, SEDIMENTS, *SULLOM VOE
1227 " POLLUTION PREVENTION, OIL TERMINALS, CONTINGENCY PLANNING, SPILL CLEANUP, *SULLOM VOE
1372 " OIL SPILLS, MARINE MAMMALS, DEVELOPMENT, BIOLOGICAL EFFECTS, *SULLOM VOE, *SEALS
1374 " NORTH SEA, DEVELOPMENT, CONTINGENCY PLANNING, BIRDS, BIOLOGICAL EFFECTS, STATISTICS, *SULLOM VOE
1400 " OIL TRANSFER, OIL TERMINALS, BIOLOGICAL EFFECTS, TANKERS, *SULLOM VOE
1209 SEA SURFACE, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS
1353 " OIL SLICKS, MODELS, DISPERSION, BEHAVIOR
1358 " MARINE ENVIRONMENT, ATLANTIC OCEAN, TAR, WEATHERING, *SARGASSO SEA
1362 " PREDICTIONS, OIL SPILLS, MOVEMENT, MODELS, DRIFT, BEHAVIOR, ARGO MERCHANT SPILL
1363 " PREDICTIONS, MOVEMENT, MODELS, DRIFT, ARGO MERCHANT SPILL
1122 SEAWATER, DETECTION, AROMATIC HYDROCARBONS
1129 " HYDROCARBONS , DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES, SPECTROMETRY
1333 " PLANTS, PAH, FRESHWATER, DISTRIBUTION, SOIL
1356 " OXIDATION, HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS
1348 SEDIMENTATION, NARRAGANSETT BAY, HYDROCARBONS , FATE, DISTRIBUTION
1117 SEDIMENTS, SAMPLING, FRESHWATER, CHEMICAL ANALYSIS, SOILS
1147 " MANUALS, HYDROCARBONS , BIOGENIC HYDROCARBONS, ANALYTICAL TECHNIQUES, WASTEWATERS
1150 " HYDROCARBONS , CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, *TLC, *COLUMN CHROMATOGRAPHY
1154 " MOVEMENT, HYDROCARBONS , CHROMATOGRAPHY, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES
1159 " SAMPLING, MARINE ORGANISMS, HYDROCARBONS , FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES
1168 " SCOTLAND, OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, *SULLOM VOE
1169 " HYDROCARBONS , GC/MS, DETECTION, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, WEATHERING
1245 " MARINE ORGANISMS, INTERTIDAL ZONE, HYDROCARBONS , DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, *RECRUITMENT
1300 " PHYSICAL ASPECTS, FRANCE, DISTRIBUTION, CRUDE OIL, BEACHES, AMOCO CADIZ SPILL, SHORELINES
1301 " PHYSICAL EFFECTS, FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, SHORELINES
1327 " HYDROCARBONS , DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES
1345 " PUGET SOUND, HYDROCARBONS , BIODEGRADATION, BACTERIA, SHORELINES
1349 " PHYSICAL ASPECTS, FATE, DISTRIBUTION, BEACHES, TAR
1359 " PAH, FATE, DISTRIBUTION, CONCENTRATIONS, SOIL, *POLLUTANT TRANSPORT
1368 " PUGET SOUND, MOVEMENT, DISTRIBUTION, CRUDE OIL, ADSORPTION, SIMULATIONS
1370 " PAH, FATE, ECOSYSTEMS, COLD CLIMATES, BIODEGRADATION, WEATHERING, ZOOPLANKTON, UPTAKE
R094 " PETROLEUM PRODUCTS, DETECTION, CRUDE OIL, CHROMATOGRAPHY, SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, *FINGERPRINTING
R110 " OCS, HYDROCARBONS , GULF OF MEXICO, BASELINE STUDIES, ATLANTIC COAST, *GEOCHEMISTRY
1394 SEGREGATED BALLAST, SAFETY, RISK ANALYSIS, POLLUTION PREVENTION, OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS, USCG
1207 SHIPS, PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS
1208 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SPILL REMOVAL
1393 " RISK ANALYSIS, OIL SPILLS, MODELS, INFORMATION SYSTEMS, TANKERS, USCG, *PIRS

1220 SHORELINES, INTERTIDAL ZONE, GUIDELINES, DISPERSANTS, CONTINGENCY PLANNING, BEACH CLEANUP, SPILL CLEANUP
1230 " POLLUTION PREVENTION, CONTINGENCY PLANNING, BEAUFORT SEA, ARCTIC, SPILL RESPONSE, SPILL CLEANUP
1253 " MORTALITY, FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL
1254 " MORTALITY, FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL
1300 " SEDIMENTS, PHYSICAL ASPECTS, FRANCE, DISTRIBUTION, CRUDE OIL, BEACHES, AMOCO CADIZ SPILL
1301 " SEDIMENTS, PHYSICAL EFFECTS, FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL
1332 " MARINE ORGANISMS, GUIDELINES, ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, TOXICITY, UK, TORREY CANYON SPILL
1345 " SEDIMENTS, PUGET SOUND, HYDROCARBONS , BIODEGRADATION, BACTERIA
1179 SIMULATIONS, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT
1199 " PHYSICAL ASPECTS, PERFORMANCE TESTING, DISPERSANTS, BEHAVIOR
1201 " PERFORMANCE TESTING, GUIDELINES, EQUIPMENT, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, *ASTM SYMPOSIUM
1225 " EQUIPMENT, DISPERSANTS, COST ANALYSIS, *AERIAL APPLICATION
1367 " PREDICTIONS, OIL SLICKS, DISPERSION, SPREADING
1368 " SEDIMENTS, PUGET SOUND, MOVEMENT, DISTRIBUTION, CRUDE OIL, ADSORPTION
1186 SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SKIMMERS, SORBENTS
1182 SKIMMERS, PERFORMANCE TESTING, EPA, DESIGN-ENGINEERING, SPILL CLEANUP, US, USSR, *OHMSETT FACILITY
1186 " SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SORBENTS
1193 " PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP
1198 " PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, SPILL REMOVAL
1202 " PERFORMANCE TESTING, EQUIPMENT, EPA, DESIGN-ENGINEERING, SPILL CLEANUP, *OHMSETT FACILITY
1203 " PATENT, OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS
1204 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP
1207 " SHIPS, PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP
1209 " SEA SURFACE, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP
1210 " OIL-WATER SEPARATION, FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, SORBENTS, SPREADING
1212 " PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, *OHMSETT FACILITY
1214 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP
1215 " PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, *OHMSETT FACILITY
1387 " MODELS, EQUIPMENT, DESIGN-ENGINEERING, TANKERS, SPILL CLEANUP
1426 SLUDGE , GRAVITY SEPARATION, FLOTATION, DISPOSAL , BIOLOGICAL TREATMENT, WASTEWATER TREATMENT
1443 " LAND FARMING, DISPOSAL , WASTE OIL
1302 SOCIOECONOMIC EFFECTS, OIL SPILLS, ARGO MERCHANT SPILL
1303 " SANTA BARBARA CHANNEL, OIL SPILLS, OIL INDUSTRY, *TOURISM
1304 " OIL INDUSTRY, OCS, DEVELOPMENT
1318 " PHYSICAL EFFECTS, OIL SPILLS, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, *PROCEEDINGS
1383 " RISK ANALYSIS, RESOURCE MANAGEMENT, PUGET SOUND, OIL SPILLS, OIL INDUSTRY, MODELS, ENVIRONMENTAL EFFECTS
1133 SOIL, PATENT, HYDROCARBONS , EQUIPMENT, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, *VOLATILIZATION
1134 " PATENT, HYDROCARBONS , EQUIPMENT, DETECTION, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES
1161 " HYDROCARBONS , CHEMICAL ANALYSIS, BEACHES, SURFACTANTS
1190 " CONTAMINATION, BIOLOGICAL TREATMENT, BIODEGRADATION, SPILL CLEANUP
1219 " RESTORATION, RECOVERY, PLANTS, MARSHES, INVERTEBRATES, CRUDE OIL, SPILL CLEANUP
1294 " GROUNDWATER, *VULNERABILITY, *BULGARIA
1298 " GROUNDWATER, FATE, ENVIRONMENTAL EFFECTS, TOXICITY
1333 " SEAWATER, PLANTS, PAH, FRESHWATER, DISTRIBUTION
1335 " MICROORGANISMS, BIODEGRADATION
1359 " SEDIMENTS, PAH, FATE, DISTRIBUTION, CONCENTRATIONS, *POLLUTANT TRANSPORT
1371 SOLID WASTES, PETROLEUM PRODUCTS, INDUSTRIES, FATE, DISPOSAL , WATER QUALITY
1421 " OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, DISPOSAL
1434 " PATENT, OIL REMOVAL, FILTRATION, WASTEWATER TREATMENT
1354 SOLUBILITY, PHYSICAL ASPECTS, HYDROCARBONS , EVAPORATION, *AIR-WATER INTERFACE, *HENRY'S LAW
1180 SORBENTS, POLLUTION PREVENTION, PATENT, EQUIPMENT, ABSORPTION, *BILGES
1183 " PATENT, SPILL CLEANUP
1185 " PLANTS, PATENT, ABSORPTION, *GRASS PEAT FIBERS
1186 " SKIMMERS, SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL

1206 SORBENTS, PATENT, OIL REMOVAL, ABSORPTION
1210 " SKIMMERS, OIL-WATER SEPARATION, FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, SPREADING
1217 " PATENT, OIL REMOVAL, ADSORPTION
1435 " PATENT, ADSORPTION, WASTEWATER TREATMENT
1149 SOURCE IDENTIFICATION, PETROLEUM PRODUCTS, CRUDE OIL, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES
1152 " SAMPLING, JAPAN, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, TAR
1157 " MARINE ORGANISMS, HYDROCARBONS , HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, *TAIWAN
1164 " PETROLEUM PRODUCTS, ANALYTICAL TECHNIQUES
1165 " RHODE ISLAND, MASSACHUSETTS, BEACHES, ARGO MERCHANT SPILL, TAR
1166 " CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS
1167 " FISH, CONTAMINATION, BIOLOGICAL EFFECTS, AUSTRALIA
1168 " SEDIMENTS, SCOTLAND, OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, *SULLOM VOE
1169 " SEDIMENTS, HYDROCARBONS , GC/MS, DETECTION, ANALYTICAL TECHNIQUES, WEATHERING
1170 " MANUALS, DETECTION, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES
1171 " NATURAL SEEPAGE, CALIFORNIA, ANALYTICAL TECHNIQUES, TAR, *SANTA MONICA BAY, WEATHERING
1172 " FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES
1173 " CONTAMINATION, ANALYTICAL TECHNIQUES, *NI/N INDEX
1174 " OIL SPILLS, ANALYTICAL TECHNIQUES
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R112 " FATE, BEACHES, TAR
R101 SOURCES, PAH, OREGON, MOLLUSKS, INVERTEBRATES, CARCINOGENS, UPTAKE
1129 SPECTROMETRY, SEAWATER, HYDROCARBONS , DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES
1153 " SAMPLING, CHROMATOGRAPHY, CHEMICAL ANALYSIS, WEATHERING
1121 SPECTROSCOPY, DETECTION, CONCENTRATIONS, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS
1162 " PAH, NEW YORK, BAYS, ANALYTICAL TECHNIQUES
1182 SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, EPA, DESIGN-ENGINEERING, US, USSR, *OHMSETT FACILITY
1183 " SORBENTS, PATENT
1186 " SORBENTS, SKIMMERS, SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL REMOVAL
1188 " POLLUTION PREVENTION, ONSHORE, INDUSTRIES, WASTEWATERS
1190 " SOIL, CONTAMINATION, BIOLOGICAL TREATMENT, BIODEGRADATION
1191 " REGULATIONS, POLLUTION CONTROL, GOVERNMENT AGENCIES, DISPERSANTS
1192 " MARINE ORGANISMS, HABITATS, DISPERSANTS, CHRONIC EFFECTS, ACUTE EFFECTS, TOXICITY
1193 " SKIMMERS, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING
1194 " POLLUTION CONTROL, PHYSICAL ASPECTS, FRANCE, BEHAVIOR, AMOCO CADIZ SPILL
1195 " PATENT, OIL REMOVAL
1196 " PATENT, ADSORPTION, WASTEWATER TREATMENT, *POWDERED SHALE
1202 " SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, EPA, DESIGN-ENGINEERING, *OHMSETT FACILITY
1204 " SKIMMERS, PATENT, EQUIPMENT, DESIGN-ENGINEERING
1205 " IRELAND, DISPERSANTS, *BETELGEUSE SPILL, *AERIAL APPLICATION
1207 " SKIMMERS, SHIPS, PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS
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1209 " SKIMMERS, SEA SURFACE, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING
1211 " EQUIPMENT, DISPERSANTS, DESIGN-ENGINEERING, *DISPERSANT APPLICATION
1212 " SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, *OHMSETT FACILITY
1214 " SKIMMERS, PATENT, EQUIPMENT, DESIGN-ENGINEERING
1215 " SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, *OHMSETT FACILITY
1216 " EQUIPMENT, DESIGN-ENGINEERING, *SIRENE
1218 " SOIL, RESTORATION, RECOVERY, PLANTS, MARSHES, INVERTEBRATES, CRUDE OIL
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1221 " POLLUTION CONTROL, FRANCE, CONTINGENCY PLANNING, COASTS, AMOCO CADIZ SPILL
1223 " PHYSICAL ASPECTS, OIL SPILLS, ARGO MERCHANT SPILL, SPILL RESPONSE
1226 " ICE, CONTINGENCY PLANNING, COLD CLIMATES, SPILL RESPONSE, USCG
1227 " SCOTLAND, POLLUTION PREVENTION, OIL TERMINALS, CONTINGENCY PLANNING, *SULLOM VOE
1230 " SHORELINES, POLLUTION PREVENTION, CONTINGENCY PLANNING, BEAUFORT SEA, ARCTIC, SPILL RESPONSE
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1324 " REMOTE SENSING, FRANCE, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BEACHES, AMOCO CADIZ SPILL
1325 " NOAA, FRANCE, EPA, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL

1332 SPILL CLEANUP, SHORELINES, MARINE ORGANISMS, GUIDELINES, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, UK, TORREY CANYON SPILL
1339 " OIL SPILLS, BIODEGRADATION, BIBLIOGRAPHIES, BACTERIA, ALGAE
1342 " PATENT, OIL REMOVAL, MICROORGANISMS, BIODEGRADATION
1387 " SKIMMERS, MODELS, EQUIPMENT, DESIGN-ENGINEERING, TANKERS
1389 " REGULATIONS, PORTS , POLLUTION PREVENTION, OIL TRANSPORT, OIL TRANSFER, OIL TERMINALS, LIABILITY, TANKERS
1407 " POLLUTION CONTROL, OIL TERMINALS, LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, IMCO, TANKERS
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R118 " OIL-WATER SEPARATION, EQUIPMENT, STORAGE, USCG
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1176 " OIL SLICKS, EQUIPMENT, SPREADING
1177 " PERFORMANCE TESTING, EQUIPMENT, EPA, DESIGN-ENGINEERING, BOOMS, *OHMSETT FACILITY
1178 " RIVERS, PRODUCT INFORMATION, PERFORMANCE TESTING, EQUIPMENT, CONTINGENCY PLANNING, CANADA, BOOMS, US
1179 " SIMULATIONS, EQUIPMENT, DESIGN-ENGINEERING, BOOMS
1181 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS
1186 SPILL REMOVAL, SPILL CLEANUP, SORBENTS, SKIMMERS, SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS
1198 " SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING
1208 " SPILL CLEANUP, SHIPS, PATENT, EQUIPMENT, DESIGN-ENGINEERING
1210 " SORBENTS, SKIMMERS, OIL-WATER SEPARATION, FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPREADING
1213 " PATENT, EMULSIFICATION
1228 " CONTINGENCY PLANNING, ARGO MERCHANT SPILL, SPILL RESPONSE, USCG
1237 " PERFORMANCE TESTING, EQUIPMENT, DISPERSANTS, CANADA, *HOVERCRAFT SPRAYING
1240 " PERFORMANCE TESTING, EQUIPMENT, DISPERSANTS, *AERIAL SPRAYING
1315 " OIL SPILLS, FRANCE, ENVIRONMENTAL EFFECTS, CONTAMINATION, AMOCO CADIZ SPILL
1456 " POLLUTION CONTROL, OIL-WATER SEPARATION, EQUIPMENT, BIBLIOGRAPHIES, BALLAST
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1197 " POLLUTION CONTROL, ECONOMICS, DISPERSANTS
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1223 " SPILL CLEANUP, PHYSICAL ASPECTS, OIL SPILLS, ARGO MERCHANT SPILL
1226 " SPILL CLEANUP, ICE, CONTINGENCY PLANNING, COLD CLIMATES, USCG
1228 " SPILL REMOVAL, CONTINGENCY PLANNING, ARGO MERCHANT SPILL, USCG
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1230 " SPILL CLEANUP, SHORELINES, POLLUTION PREVENTION, CONTINGENCY PLANNING, BEAUFORT SEA, ARCTIC
1235 " REGULATIONS, POLLUTION CONTROL, LEGISLATION, LAW ENFORCEMENT, GOVERNMENT AGENCIES
1241 " SPILL CLEANUP, SAMPLING, FUEL OIL, EPA, CONTINGENCY PLANNING, BUZZARDS BAY, BOUCHARD 65 SPILL, BIOLOGICAL EFFECTS
1317 " OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS, *CRISTOS BITAS SPILL
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Australian Patent	
498,043	79D-1193
Austrian Patent	
348,491	79D-1217
British Patent	
1,535,606	79D-1455
1,535,848	79D-1437
East German Patent	
132,211	79D-1133
132,212	79D-1134
French Patent	
2,351,404	79D-1126
German Patent	
2,715,118	79D-1136
2,751,738	79D-1119
2,806,851	79D-1442
2,846,926	79D-1213
Japanese Patent	
77 42,738	79D-1458
78 18,194	79D-1196
78 50,056	79D-1424
78 54,176	79D-1447
78 87,793	79D-1137
78 97,256	79D-1425
79 02,287	79D-1206
79 06,498	79D-1454
79 08,557	79D-1185
79 09,450	79D-1466
79 10,561	79D-1441
79 18,152	79D-1446
79 18,480	79D-1457
79 30,659	79D-1434
79 33,887	79D-1195
79 37,070	79D-1435

PATENT	CITATION NO.
Netherlands Patent	
7 802,657	79D-1207
7 806,198	79D-1208
Swedish Patent	
405,981	79D-1183
US Patent	
4,021,333	79D-1463
4,028,226	79D-1462
4,031,839	79D-1180
4,032,439	79D-1436
4,042,495	79D-1342
4,049,553	79D-1444
4,053,414	79D-1203
4,071,438	79D-1465
4,133,765	79D-1214
4,145,286	79D-1413
4,145,287	79D-1460
4,145,290	79D-1204
4,146,344	79D-1181
4,146,482	79D-1209
USSR Patent	
648,527	79D-1418

APPENDIX A
Periodicals Reviewed

Abstracts on Health Effects of Environmental Pollutants
Alternatives: Perspectives on Society and Environment
Ambio
American Fisheries Society Transactions
Analytical Chemistry
Applied Ecology Abstracts
Applied Energy
Applied Microbiology
Applied Science & Technology Index
Aquatic Sciences & Fisheries Abstracts
Audubon
Australian Science Index
Berichte der Deutschen Wissenschaftlichen Komission fuer Meeresforschung
Bibliography and Index of Geology
Biological Abstracts
Bioresearch Index
Bioscience
British Birds
British Library. Lending Division. Index of Conference Proceedings Received
Bulletin of Environmental Contamination and Toxicology
Bulletin of Marine Science
Catalyst for Environmental Quality
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemistry in Canada
Chemosphere
Coastal Engineering
Coastal Zone Management Journal
Conservation News
Current Contents: Life Sciences
Current Contents: Physical and Chemical Sciences
Deep-Sea Research/Oceanographic Bibliography
Ecological Abstracts
Ecological Modelling
The Ecologist
Ecology Law Quarterly
Effluent & Water Treatment Journal
Energy Information Abstracts
Energy Review
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Environment

Environment Abstracts
Environment Reporter
Environmental Action
Environmental Conservation
Environmental Geology
Environmental Health and Pollution Control
Environmental Management
Environmental Periodicals Bibliography
Environmental Pollution
Environmental Research
Environmental Science & Technology
Environmental Technology and Economics
EPA Environmental News
EPA Reports Bibliography Quarterly
ERDA Energy Research Abstracts
Estuarine and Coastal Marine Science
Fuel Abstracts and Current Titles
Geochimica et Cosmochimica Acta
Government Reports Announcements
Groundwater
Hydrocarbon Processing
India Journal of Environmental Health
Industrial Wastes Information Bulletin
INTERDOK Directory of Published Proceedings
International Aerospace Abstracts
International Journal of Ecology and Environmental Science
International Journal of Environmental Analytical Chemistry
International Journal of Environmental Studies
International Petroleum Abstracts
Iranian Journal of Science and Technology
The Journal of Applied Ecology
Journal of Canadian Petroleum Technology
Journal of Chromatography
Journal of Environmental Science and Health, Part A
Journal of Environmental Sciences
Journal of the Institute of Water Pollution Control
Journal of Petroleum Technology
Journal of the Fisheries Research Board of Canada
Journal of Toxicology and Environmental Health
Limnology and Oceanography
Marine Biological Association of the United Kingdom, Journal
Marine Biology
Marine Chemistry
Marine Geology
Marine Geotechnology
Marine Policy
Marine Pollution Bulletin
Marine Pollution Research Titles
Marine Science Contents Tables
Marine Technology
Marine Technology Society, Journal
Maritime Research Information Service Abstracts
Microbial Ecology
National Fisherman
National Research Council, News Report

National Wildlife
Nature
New Technical Books
Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of Scientific Fisheries
Northwest and Alaska Fisheries Center Monthly Reports
Ocean Engineering
Ocean Industry
Ocean Management
Oceanic Abstracts
Oceanographic Abstracts and Bibliography
Oceanus
Offshore
Oil and Gas Journal
Oil Spill Intelligence Report
Outdoor California
Pacific Oil World
Petroleum Abstracts
Petroleum Engineer International
Petroleum Today
Pollution Abstracts
Pollution Engineering
Proceedings in Print
Progress in Water Technology
Rapports et Proces Verbaux
Resources
Resource Recovery and Conservation
Royal Society of London, Proceedings, Series B, Biological Sciences
Science
The Sciences
Science News
Science of the Total Environment
Scientific and Technical Aerospace Reports
Scientific Meetings
Sea Frontiers
Sea Secrets
Sea Technology
Selected Water Resources Abstracts
Shore and Beach
Spill Technology Newsletter
Summaries of Foreign Government Environmental Reports
Tanker Advisory Center Newsletter
Technical Book Review Index
Technology Review
Toxicity Bibliography
UDS Water Quality Control Digest
Underwater Information Bulletin
Underwater Naturalist
Waste Materials Biodegradation Research Titles
Water, Air and Soil Pollution
Water & Pollution Control
Water & Wastes Engineering
Water Pollution Control Federation, Journal
Water Research
Western Fisheries

APPENDIX B
OIL POLLUTION ABSTRACTS--AVAILABILITY LISTING

OPA -current title: OIL POLLUTION ABSTRACTS
OPR -former title: OIL POLLUTION REPORTS
OSOPR-former title: OIL SPILL AND OIL POLLUTION REPORTS

TITLE	REPORT PERIOD	EPA ACCESSION NUMBER	NTIS ORDER NUMBER	PRICE	PAGES
OSOPR	Jul 74-Oct 74	EPA 670/2-75-003	PB 240-719	$ 9.25	206
OSOPR	Nov 74-Feb 75	EPA 670/2-75-044	PB 242-542	10.75	261
OSOPR	Feb 75-Apr 75	EPA 670/2-75-059	PB 243-724	9.50	235
OSOPR	May 75-Jul 75	EPA 600/2-76-129	PB 258-852	12.00	315
OSOPR	Aug 75-Oct 75	EPA 600/2-76-113	PB 258-745	11.75	299
OSOPR	Nov 75-Jan 76	EPA 600/2-76-185	PB 257-886	12.50	353
OSOPR	Feb 76-Apr 76	EPA 600/2-76-215	PB 259-932	11.75	308
OSOPR	May 76-Jul 76	EPA 600/2-76-266	PB 264-870	12.50	345
OSOPR	Aug 76-Oct 76	EPA 600/2-77-037	PB 267-266	11.75	307
OSOPR	Nov 76-Jan 77	EPA 600/2-77-075	PB 268-248	11.75	294
OSOPR	Feb 77-Apr 77	EPA 600/2-77-111	PB 272-689	12.50	326
OSOPR	May 77-Jul 77	EPA 600/2-77-243	PB 276-691	13.00	375
OSOPR	Aug 77-Oct 77	EPA 600/2-78-005	PB 281-114	11.00	280
OSOPR	Vol. 5, No. 1 Nov 77-Jan 78	EPA 600/2-78-071	PB 281-671	9.25	190
OPR	Vol. 5, No. 2 Feb 78-May 78	EPA 600/7-78-160	PB 287-071	10.75	242
OPR	Vol. 5, No. 3 Jun 78-Sep 78	EPA 600/7-78-218	PB 290-227	11.75	294
OPR	Vol. 5, No. 4 Oct 78-Dec 78	EPA 600/7-79-040	PB 293-315	9.25	189
OPA	Vol. 6, No. 1 Jan 79-Mar 79	EPA-600/7-79-160	PB ___-___	__.__	197
OPA	Vol. 6, No. 2 Apr 79-Jun 79	(Submitted 7/79)	PB ___-___	__.__	233
OPA	Vol. 6, No. 3 Jul 79-Sep 79	(Submitted 10/79)	PB ___-___	__.__	267
OPA	Vol. 6, No. 4 Oct 79-Dec 79	(Submitted 1/80)	PB ___-___	__.__	200

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